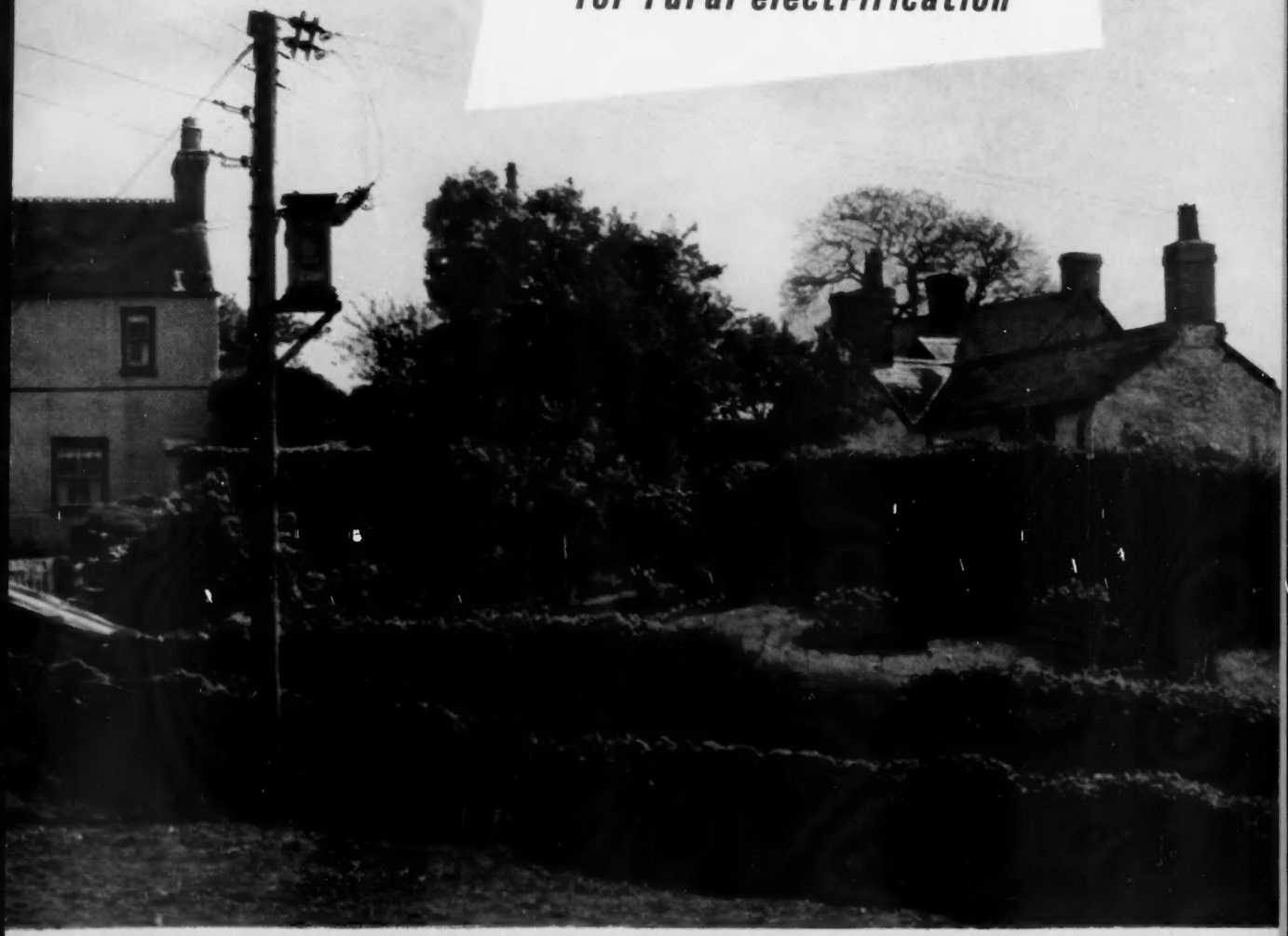
18 NOVEMBER 1954 NINEPENCE

ELECTRICAL TIMES

'ENGLISH ELECTRIC'
transformers
for rural electrification



THE ENGLISH ELECTRIC COMPANY LIMITED, QUEENS HOUSE, KINGSWAY, LONDON, W.C.2
Transformer Department, Liverpool
TL.13/4 WORKS: STAFFORD · PRESTON · RUGBY · BRADFORD · LIVERPOOL · ACCRINGTON

THIS WILL CAUSE A MIGHTY BIG RIPPLE!

Creda Double 'D' Redhead

We caused a big ripple with the introduction of the Creda Redhead Immersion Heater and the Double 'D' Redhead will be even more successful BECAUSE

★ It's the most efficient and versatile heater made

★ Although the range of thermostats is now much greater, it is not necessary to increase your stocks of immersion heaters to meet all demands.

★ Prices are unchanged (leaflet W H. 2036 refers)

★ Range of heaters unchanged 11½" - 36"

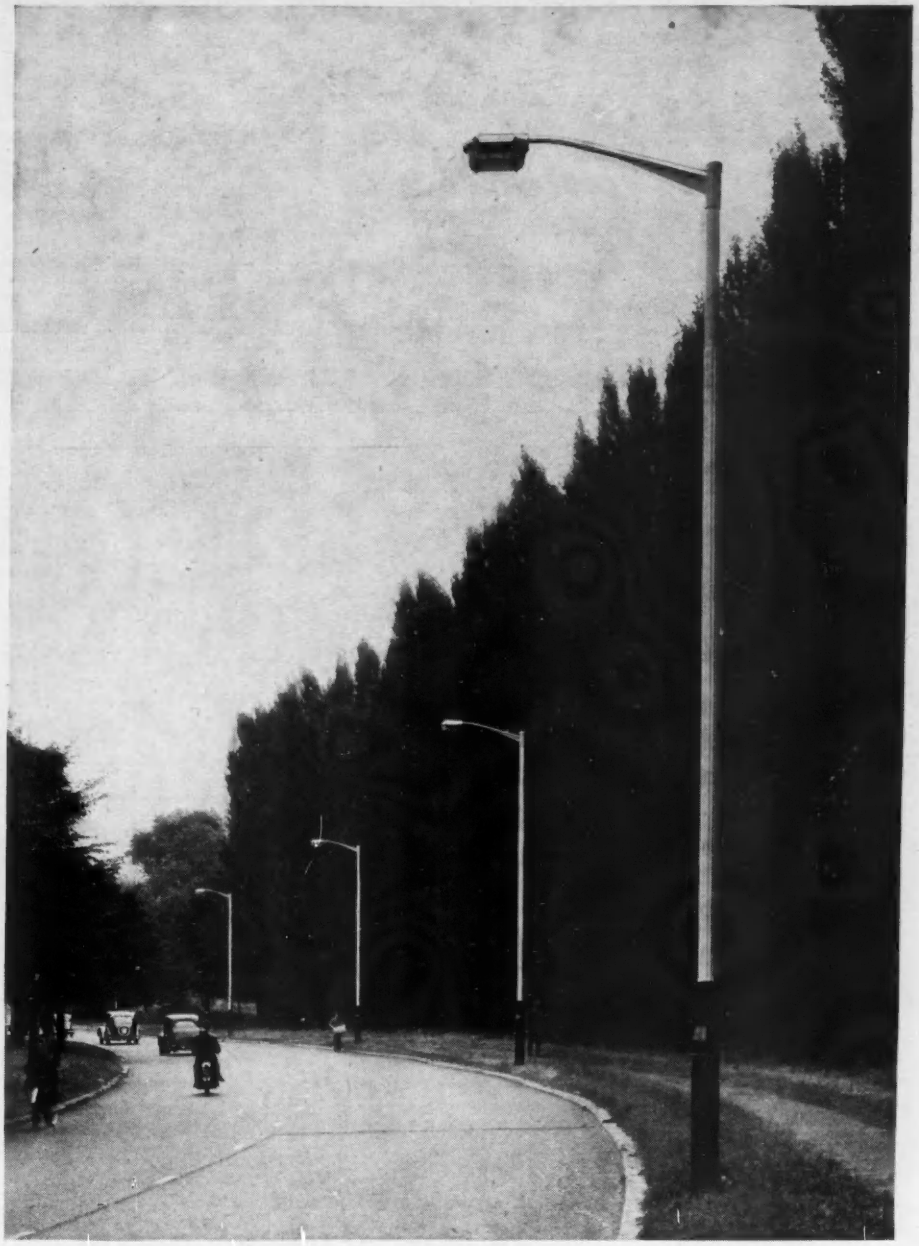
The Double Diameter thermostat pocket will accommodate the conventional rod type thermostat to BS. 1555 or the new large diameter short stemmed thermostat

WRITE FOR LITERATURE

Creda WATERHEATERS MADE BY THE HOUSE OF Simplex

Simplex Electric Co Ltd Blythe Bridge Staffs

A TI COMPANY



TUBULAR STEEL LIGHTING COLUMNS

Type Gb 588, 25 ft. M.H. for Group 'A' Roads

SUITABLE FOR ELECTRIC LIGHTING

This is one of a series of illustrations indicating our range of standard tubular steel lighting columns, passed by the Council of Industrial Design.
Other designs, plain or fluted, for 13 ft., 15 ft., and 25 ft. mounting heights, will appear from time to time. A folder showing our standard columns will be sent on application.

STEWARTS AND LLOYDS LIMITED

GLASGOW • BIRMINGHAM • LONDON

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Every picture tells a complete story—

When the crowd leaves the cinema no one—except perhaps *you*, the contractor!—wonders about how the seats, the electrical and heating installations and the rest are fixed. There's a complete story here behind the scenes, a story of absolute efficiency—Rawlplug Fixing Devices holding firm in a hundred different fixing jobs. Every one of those screw and bolt fixings was completed far more speedily with Rawlplug Fixing Devices. They will save *you* time and money too!

Write our Technical Dept. about your fixing problem.

THE RAWLPLUG COMPANY LTD CROMWELL ROAD · LONDON · S W 7 **THE WORLD-WIDE FIXING DEVICES ORGANISATION** B481

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TECHNICAL SERVICE

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HEAVY DUTY TUMBLER SWITCHES

for panel manufacturers . . .

250, 440 and 600 VOLTS AC/DC

The switches illustrated below are shown approximately $\frac{3}{4}$ actual size. Each switch is available for the above three voltages.

No. 80060
Double pole, 60 amps 250v.,
45 amps 440v., 35 amps 600v.,
A.C./D.C. Moulded base.

No. 80104 P
Triple pole, 30 amps 250v.,
25 amps 440v., 20 amps 600v.,
A.C./D.C. Porcelain base.

No. 80094
Double pole, 30 amps 250v.,
25 amps 440v., 20 amps 600v.,
A.C./D.C. Moulded base.

- **For panel or baseboard mounting**
- **Very compact for ratings**
- **Quick make-and-break mechanisms**
- **Generous insulation and large terminals**
- **Panels fitted with *Arrow* tumbler switches readily obtain Lloyds and similar overseas official approvals.**

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SEND FOR CATALOGUE H.

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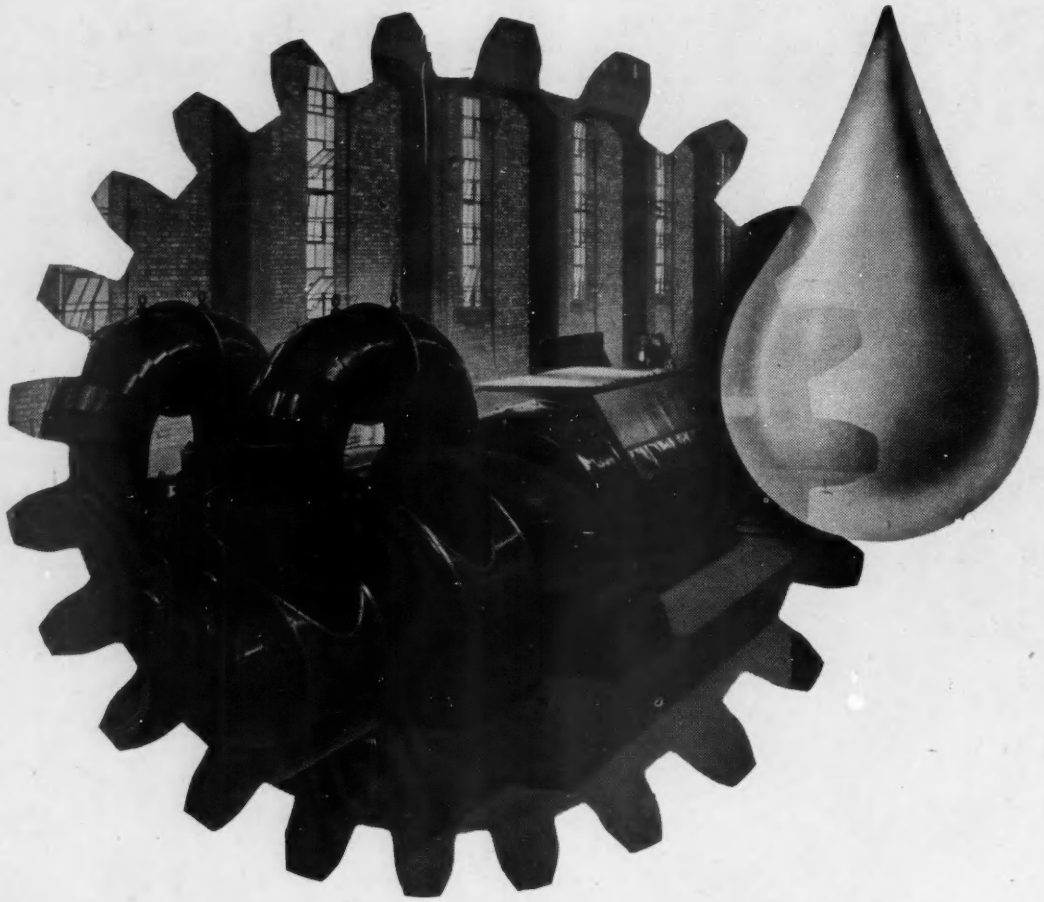

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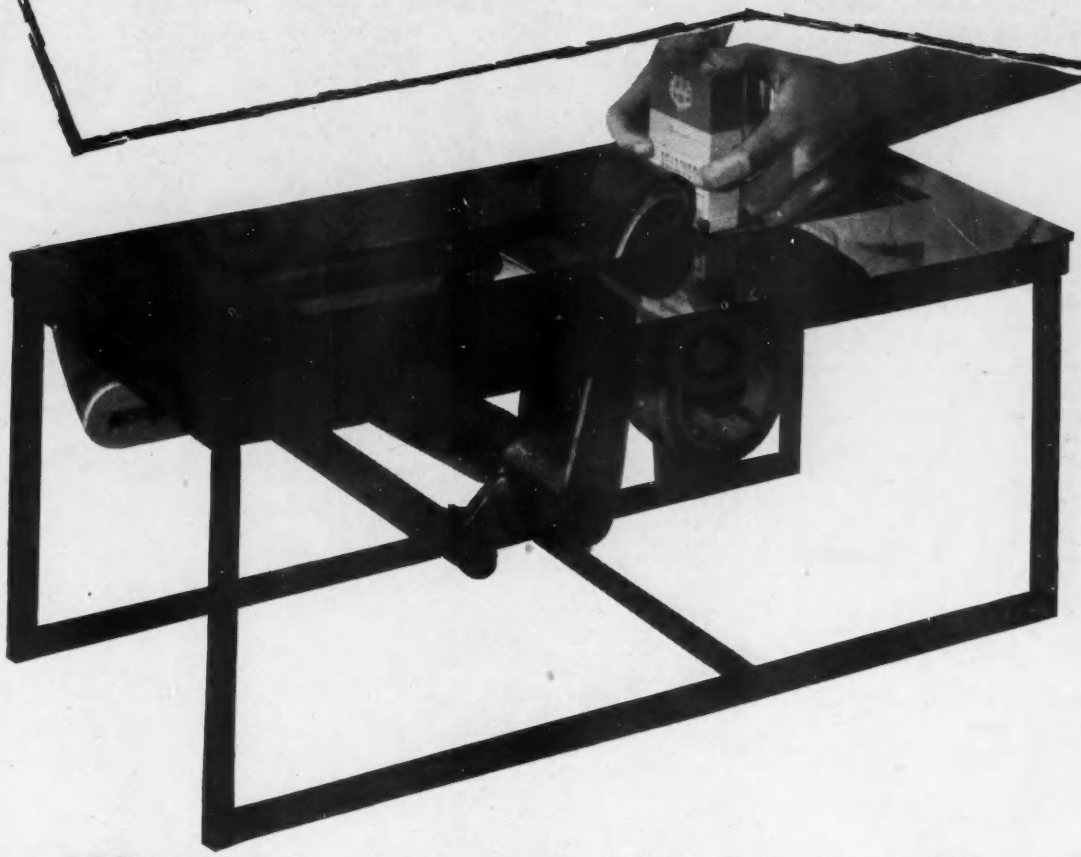
a new Permacel TRADE MARK packaging aid



The PERMACEL TRADE MARK corner sealer for 2-inch width tape

One swift, flowing movement is all that is needed to seal the end of a box or package with the Permacel Corner Sealer. The package is placed on a small movable platform, baize-covered to protect the package, and is moved forward over a rubber roller which presses the tape firmly into position. Adjustable roller height—to ensure maximum adhesion ; adjustable curved plate and metal tongue—to keep the package upright are additional features of this sturdy little machine. Besides taking any *width* of Permacel Cellulose or PVC (unplasticised) self-adhesive tape up to 2 inches, the *length* of the strips dispensed can be varied, 5 inches being the maximum. Send for more details of the Permacel Corner Sealer and learn more about the new way to save time and money in packaging. Enquiries to Dept. ET, Industrial Sales Division.

Permacel TRADE MARK

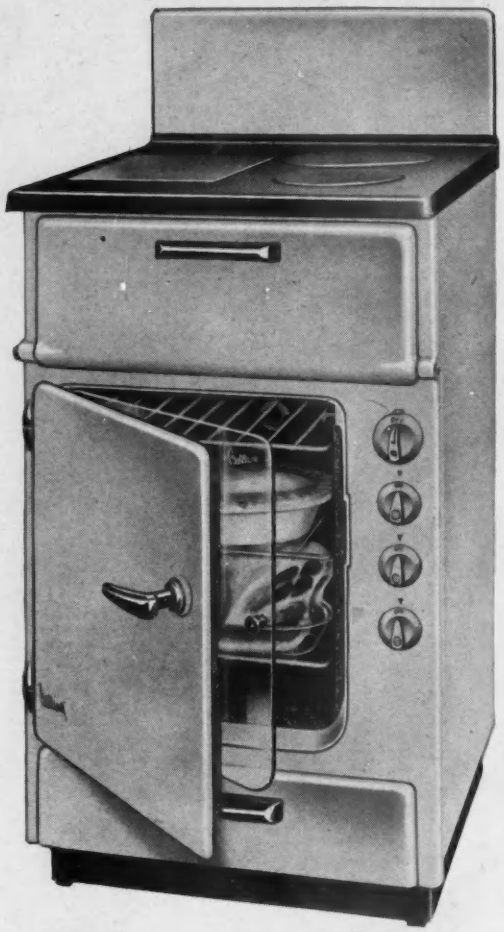
SELF-ADHESIVE TAPES

Johnson & Johnson (G.B.) LTD., SLOUGH, BUCKS

Tel: Slough 25521 (8 lines)

16-12A

a practical, reliable and thoroughly tested cooker



BRIEF SPECIFICATION

Large one-piece oven with FULL-SIZE inner glass door and thermostat, 8" boiling plate with Simmerstat, 6½" boiling plate and 10½" x 8" grill-boiler with three-heat controls. Vitreous enamel throughout. Utensil drawer optional, 24/- extra.

LIST NO. 47AB

£32.5.0

including inner glass door.

LIST NO. 47A

without glass door

£29.17.6

with everything PLUS the inner glass door

You can't beat a Belling 47AB! Wholehearted recommendations of satisfied users plus continuous national and local advertising have made it the best known cooker in the country. Easy selling, low maintenance costs, and proved reliability make it an ideal cooker for hire purchase schemes or cash sales.

"Belling" 47AB

BELLING & COMPANY LIMITED, BRIDGE WORKS, ENFIELD, MIDDX. • HOWARD 1212

CRC421

"Give me room!"

GASPED THE PRODUCTION MANAGER

"I'm being choked", he said. "I'm producing the goods faster than ever, but what's the good? I've got to slow down to enable the stuff to be moved off the floor. I've carried on somehow, but this is the end. Come and look." We did.

His production machinery was tip-top, but oh!—his materials handling equipment was right out of the Ark! "For months now I've been nagging the Board to call in Yale", he moaned, "but they just wouldn't listen."

"Well, now we're here, let's get down to it", we said as gently as we could. He showed us what wanted moving—how far—and how often. Together we worked out a scheme that did all that and *increased his effective storage space more than 25%!*

Now he's producing to capacity, his handling costs are less than he had ever hoped and the Yale trucks are giving him the kind of trouble-free service he'd only dreamed about.

IS LACK OF SPACE RESTRICTING YOUR OUTPUT?

Yale's versatile

"WORKSAVER"

is specially suitable for smaller plants

FORK LIFT *Lifts, moves and stacks over low-load floors: saves time, space and manpower wherever it's put to work.*

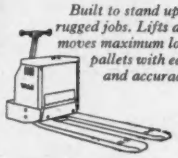
AMONG the wide range of Yale handling equipment the "Worksaver" series of trucks is of special interest to factories where restricted space or low-load floors have previously made mechanical handling impractical. Its small size, light weight and extreme ruggedness give big-truck advantages with small-truck economy and convenience.

It will lift, move and stack raw materials or finished products. It saves time, space and manpower. You can ride it or walk it. And it will start cutting costs from the minute you put it to work.

The "Worksaver" is available in five basic types: pallet, low lift platform, high lift platform, fork lift and tractor.

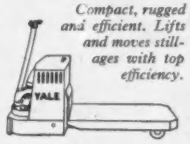
PALLET

Built to stand up to rugged jobs. Lifts and moves maximum load pallets with ease and accuracy.



PLATFORM

Compact, rugged and efficient. Lifts and moves stillages with top efficiency.



TRACTOR

A powerful and manœuvrable tractor unit to pull trailers or trailer trains with up to 700 lbs. drawbar pull.

YOU GET ALL THESE ADVANTAGES WITH THE "WORKSAVER"

- *Manœuvrable in small spaces and narrow aisles.*
- *Light weight with great strength and power permit heavy duty work on low-load floors.*
- *Dead man control cuts power and applies brakes automatically in emergency.*
- *Simple fingertip controls—unskilled staff can move, lift and stack with speed and safety.*
- *Low initial cost, low running cost, economical maintenance, long life.*

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MADE IN ENGLAND BY **YALE**

REGISTERED TRADE MARK

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WITH THIS NAME—

The new H.M.V. "Milady's Iron" couldn't be better named. It is the aristocrat of all the popular priced irons, designed to save work and time for every woman who owns one. Add to that the name of H.M.V.—makers of the first thermostatically controlled iron in Britain and the world's leading creators of modern household appliances—and the sensational reception of the new H.M.V. iron is hardly surprising!

at this price!

NO OTHER IRON OFFERS SO MUCH FOR SO LITTLE **39/6**

ALSO AC/DC VERSION **42/6**

Milady's has everything—

- **SNAP-ACTION THERMOSTAT** for accurate temperature-control
- **MEDIUM WEIGHT** (approx. 4 lbs) for all ironing
- **CLEARLY LABELLED CONTROL SETTING KNOB**
- **INTERFERENCE SUPPRESSION**
- **RUST-PROOF** vitreous enamelled body
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- **ADJUSTABLE FOR RIGHT OR LEFT HAND USER**
- **SPECIAL ELEMENT** ensures even soleplate temperatures
- **CONFORMS TO BRITISH SAFETY STANDARD** No. 1732/1951
- **CARRIES "GOOD HOUSEKEEPING"** Guarantee Seal No. 1664

Display "Milady's Iron" now—and don't delay ordering your stocks and sales literature from our wholesale distributors.

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CHAIRMAN WALTER F. HIGGS M.I.E.E.

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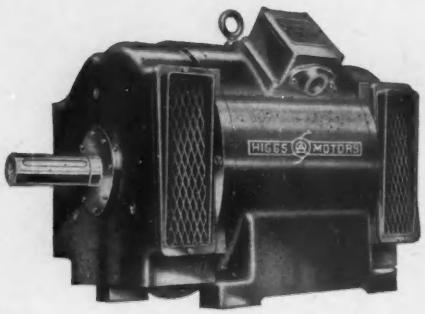

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for
Heavy Duty plus Reliability

GUARANTEED FOR EVER

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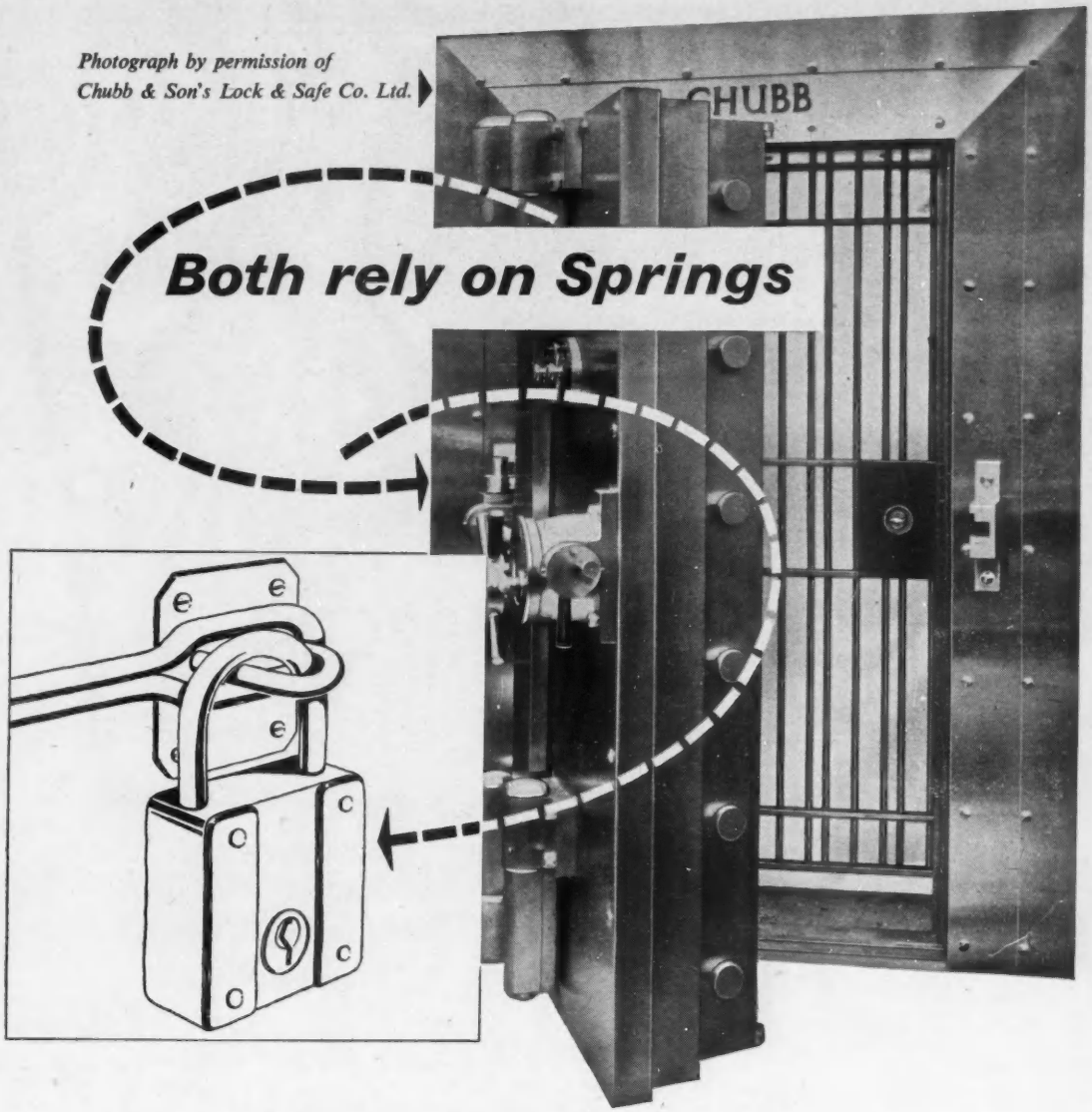

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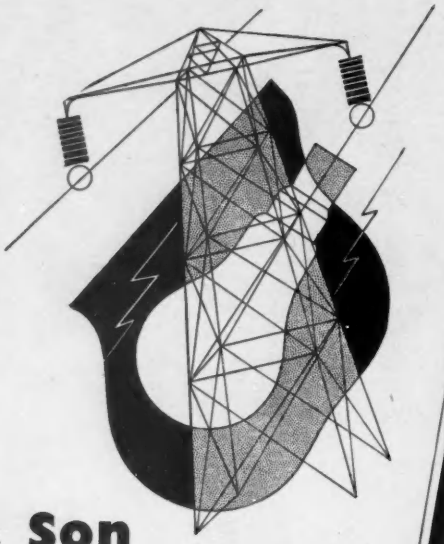

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★ ★ *16,800 lumens average through life*

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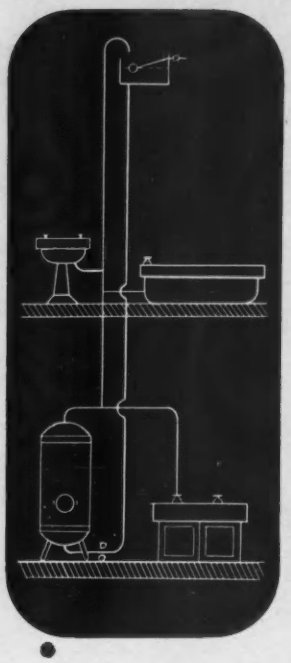
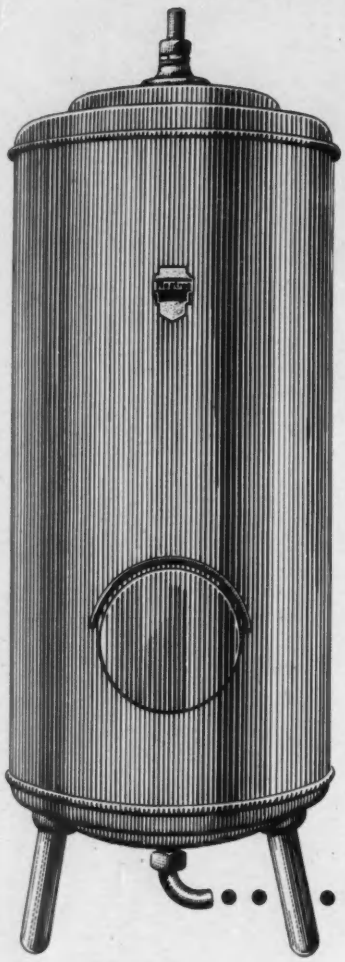
SIMPLICITY — THE KEYNOTE OF GENIUS

Heatrae electric water heaters



Ideal for long and arduous service



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- Capacity ranges from 30-125 gallons.
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- Horizontally placed low heat intensity removable core heating units give long life under hard water conditions.
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- Enclosed in corrosion proofed casing.
- Finished attractively in white enamel.

Special attention should be given to pipe runs. The diagram shows ideal feed from cistern, and our leaflet **DEB** *gives fullest information of a wide range of application.*

Write us for a copy which also gives details of our Type **R.T.** (wall pattern) **Heater.**

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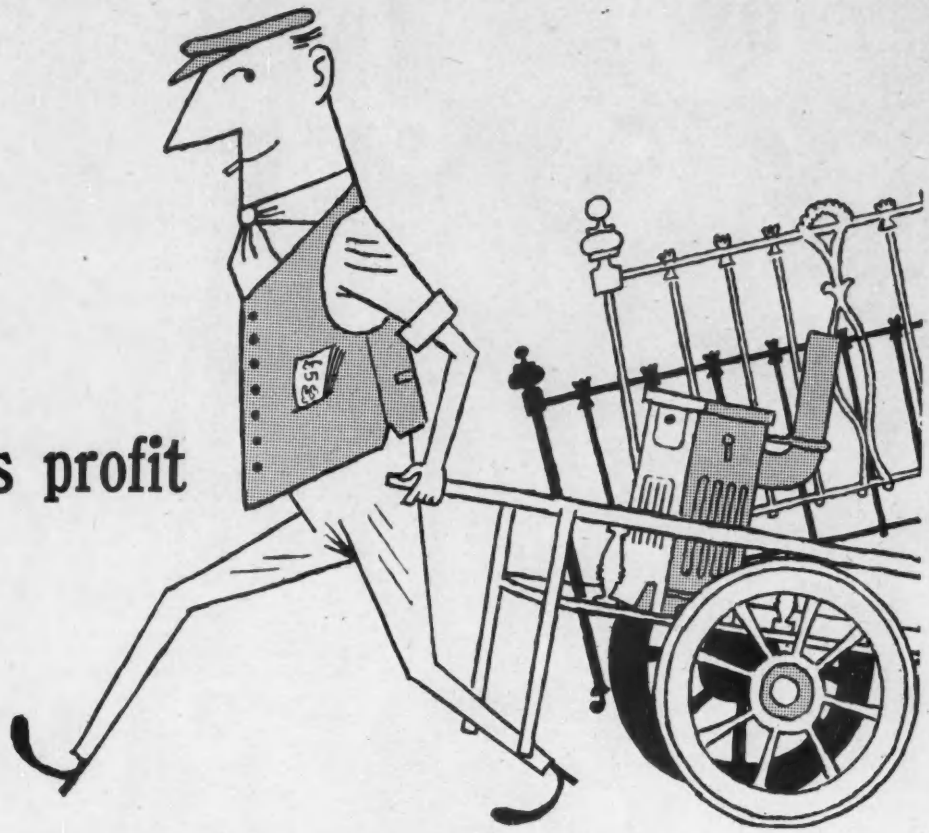

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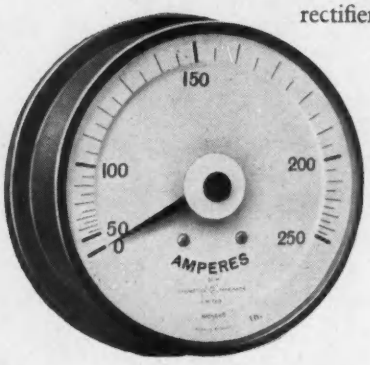

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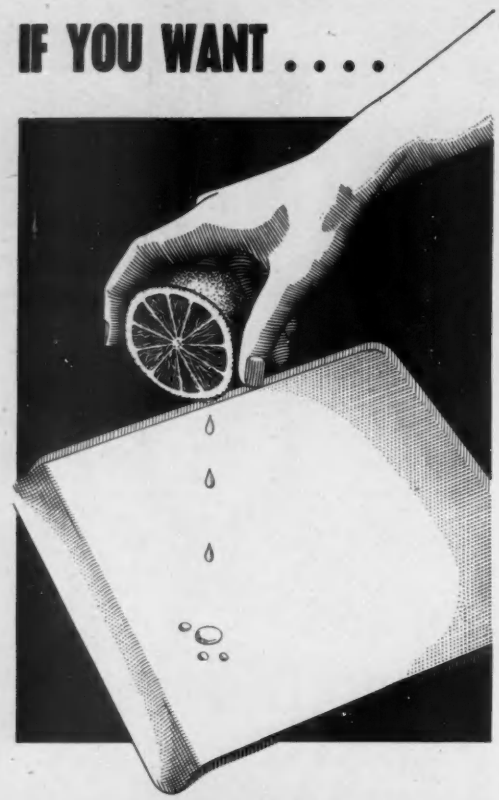

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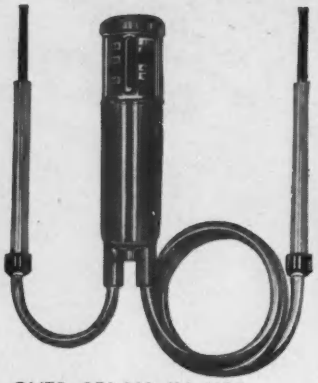

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STURDY TRANSFORMERS

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They are being supplied regularly to Government Departments — N.C.B. B.E.A. and many large industrial users.

OUR MANY CUSTOMERS ARE OUR RECOMMENDATION

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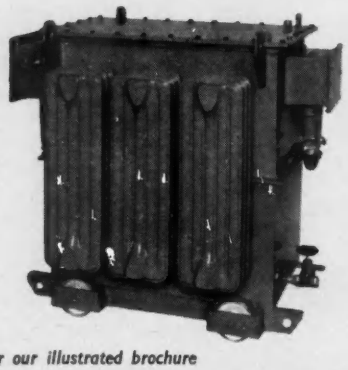

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STURDY ELECTRIC COMPANY LIMITED

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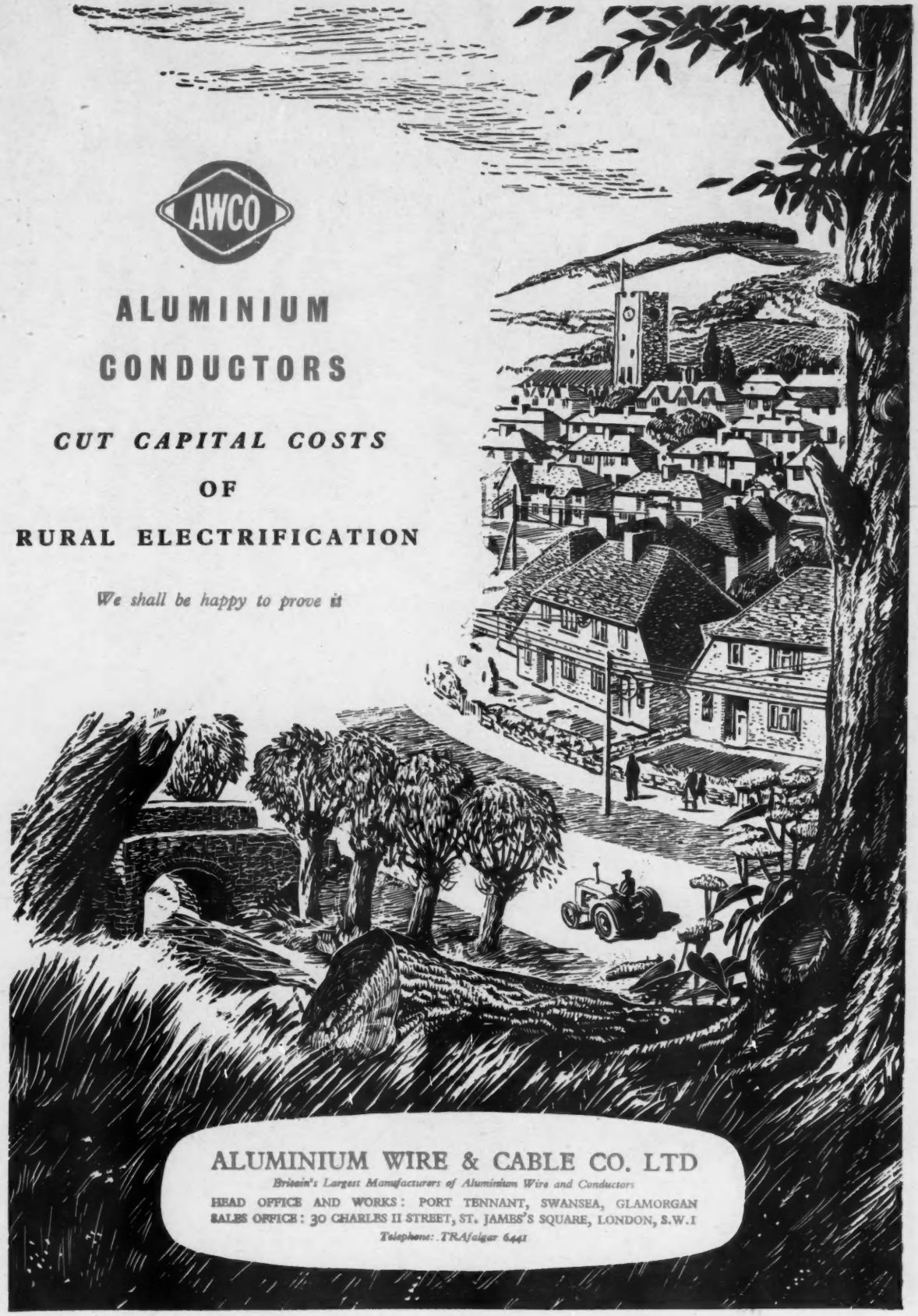
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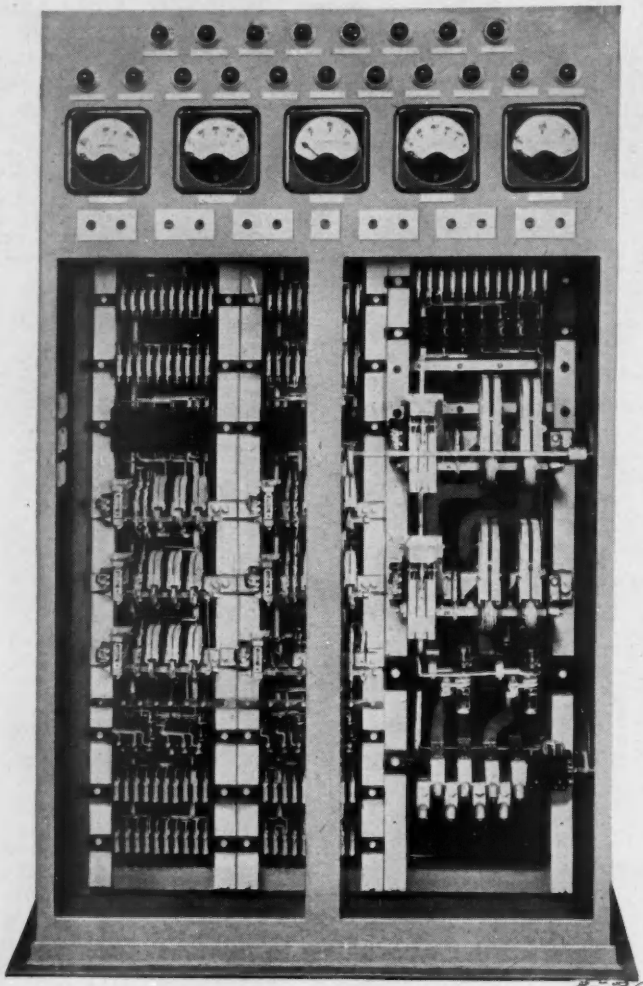

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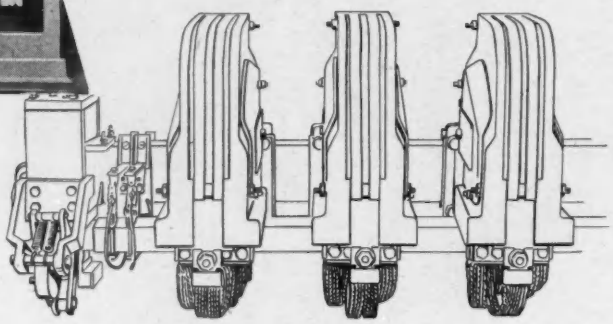

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Resistant to high temperature — good conductivity — short, clean "break". Life of G.W.B. contacts many times greater than conventional copper types.

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The Industrial Instrument Division of S. Smith & Sons (England) Ltd.

188-276

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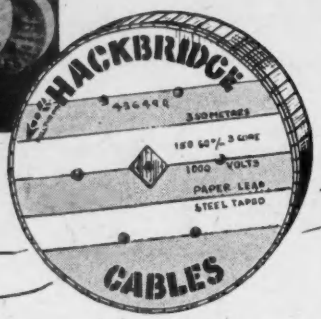

ELECTRIC CABLES OF ALL TYPES

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Cable Company Limited

In Association with
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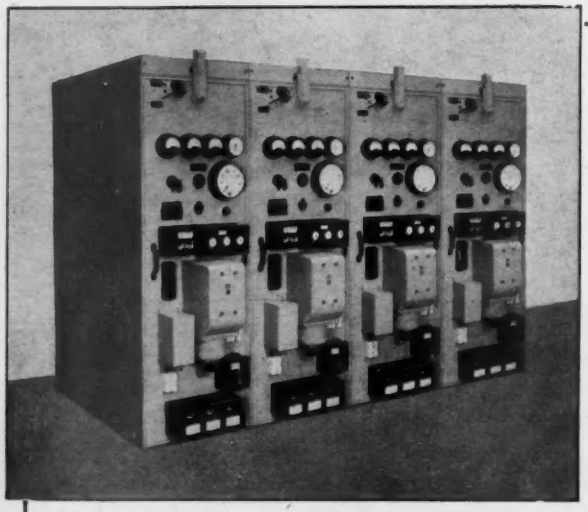

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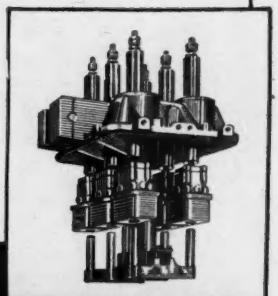
Switchgear
with
TYPE H. 25
oil circuit breakers
6·6 & 11kV.

The switchgear is of the air insulated truck or fixed cubicle pattern. The oil circuit-breakers are A.S.T.A. certified and may be arranged for hand, spring or solenoid operation. They can be supplied as loose units for the replacement of obsolete breakers.



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MODEL TS

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The perfect small washing machine - heats the water - 6 lb capacity - 12 inch fold-down hand wringer - special Swirlux agitator (non-heated version Type 500 also available)

MODEL TS

500H

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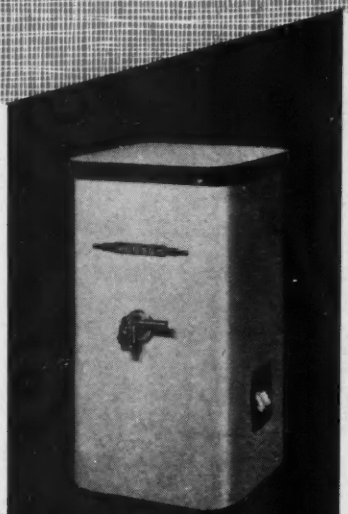

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VERSCO

ROUND BOILER

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SQUARE BOILER

This smart and compact boiler is fitted with castors for easy movement and is finished in cream stove enamel. The table-top in cream vitreous is an attractive feature.

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PYRAMID policy of designing the best utensil for electric cooking makes maximum speed and economy certain.
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TWO RANGES TO COVER ANY TYPE OF COOKING:
Pyramid Ground Base gives the best results on solid hotplates.
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Have you progressed to Pyramid?

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The ½ h.p. 'ENGLISH ELECTRIC' Magamp will give you push-button control in forward or reverse and flexible speed variation over an 8 : 1 speed range for a thousand and one tasks.

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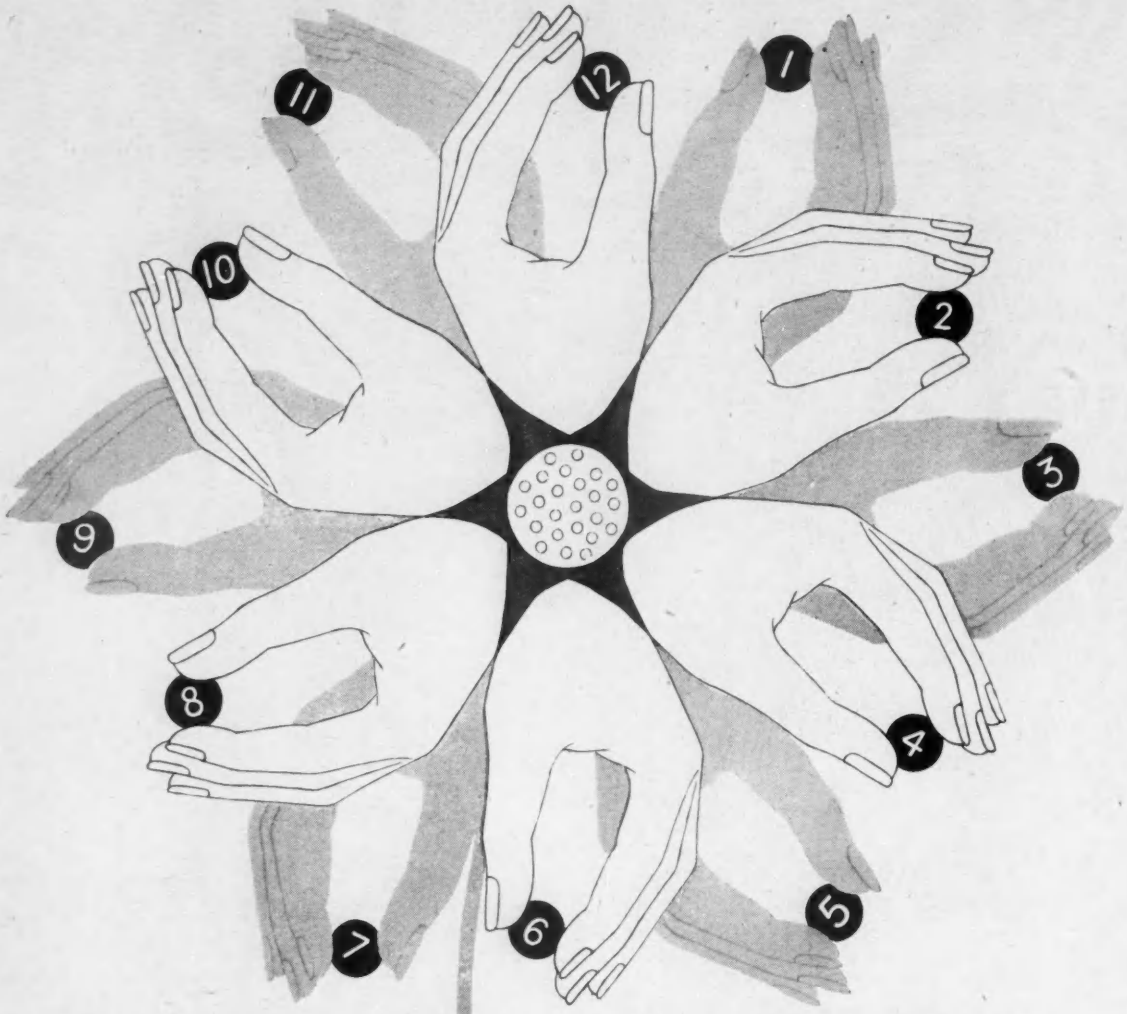

Resourcefulness in bloom . . .

Originality must always lie in an ability to blossom forth. If you look at the Crompton Parkinson organisation you will find that we have done exactly that thing. From the small bud that was Colonel Crompton's original Company 75 years ago have sprung today twelve outstanding petals—each a department that is representative of the important things in electrical equipment and installation.

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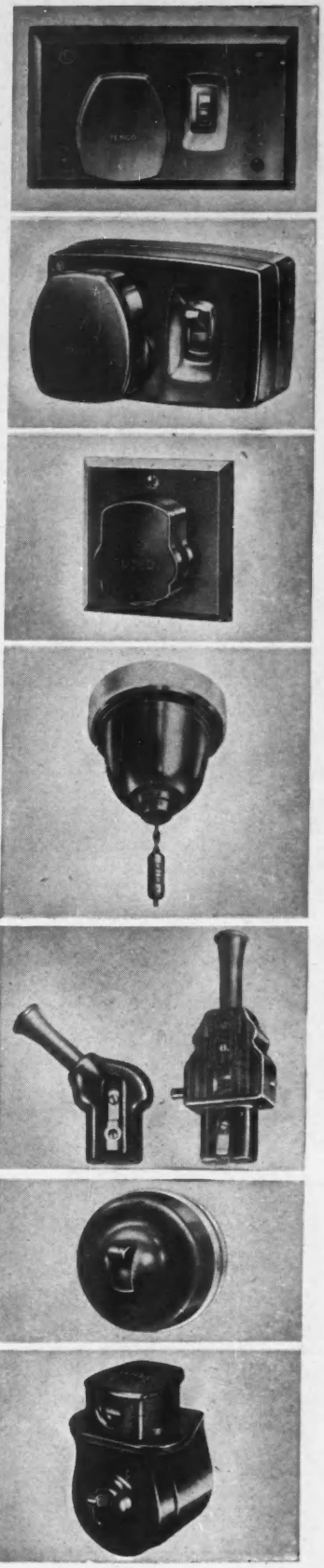

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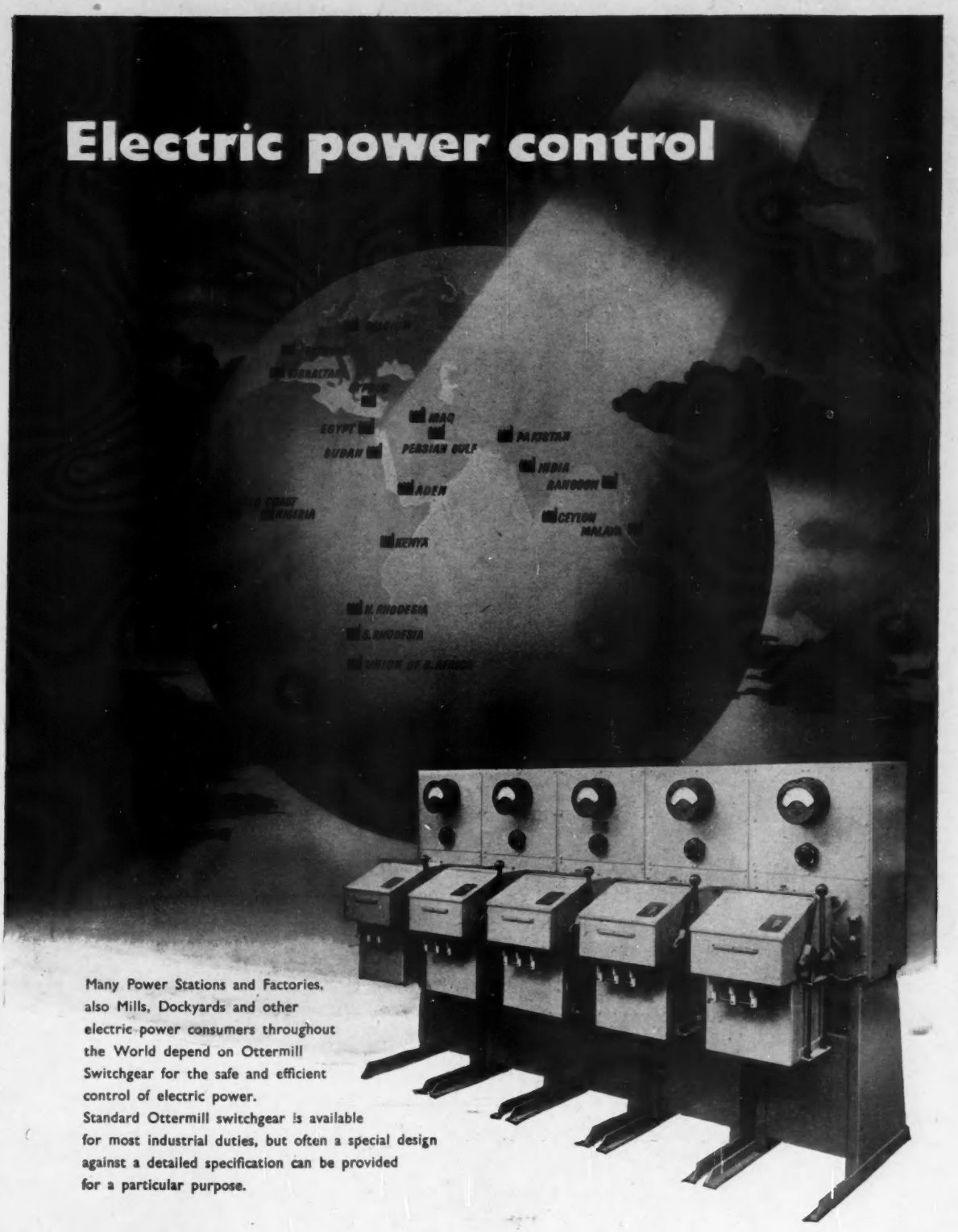
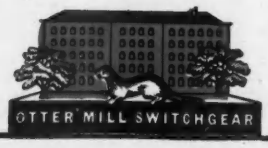
Electric power control



Many Power Stations and Factories, also Mills, Dockyards and other electric power consumers throughout the World depend on Ottermill Switchgear for the safe and efficient control of electric power.
Standard Ottermill switchgear is available for most industrial duties, but often a special design against a detailed specification can be provided for a particular purpose.



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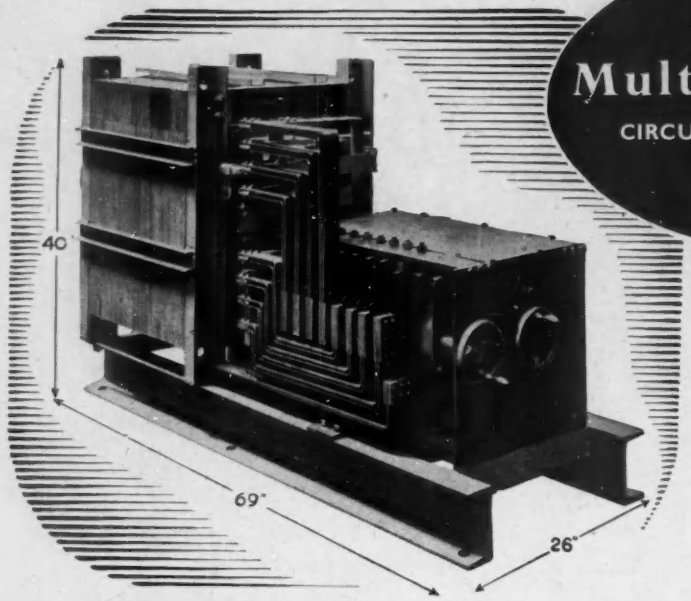

550 kVA transformer with 2,000 amps. continuously rated tap switch.

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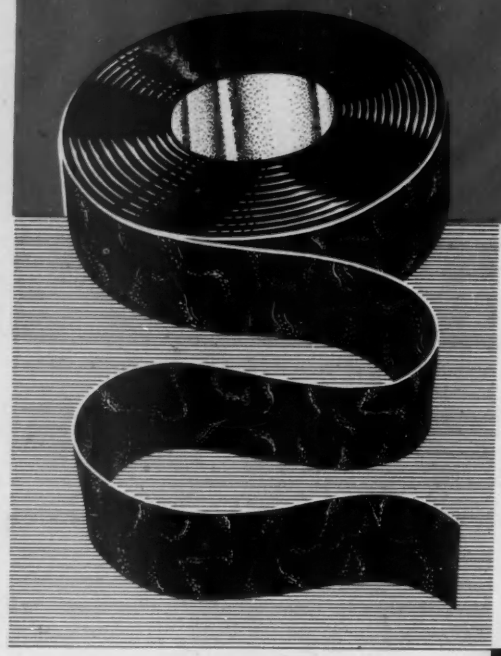

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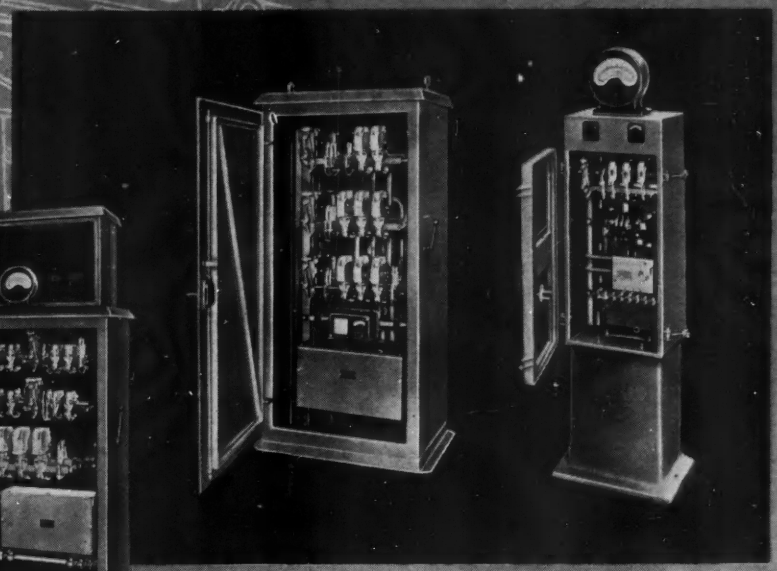
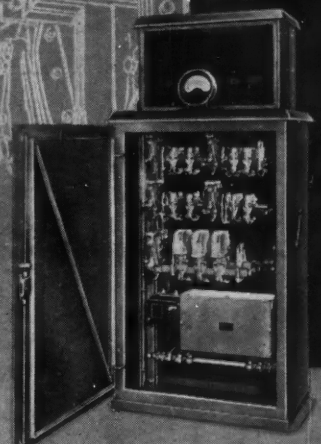


60 h.p. Star-Delta Starter

20 h.p. Direct-to-line Starter



120 h.p. Stator/Rotor Starter

For Industrial Applications

CONTACTOR SWITCHGEAR LTD. manufacture a wide range of standard contactor type starters and accessories to meet the varied requirements of mechanised industry. The range of starters commences with the type DS.25 (A.C. direct switching) which is rated up to 7½ h.p. (400/440 volts), and at this voltage is available from stock.

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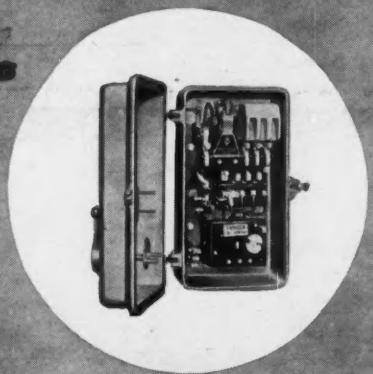

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Hydro-Electric Station

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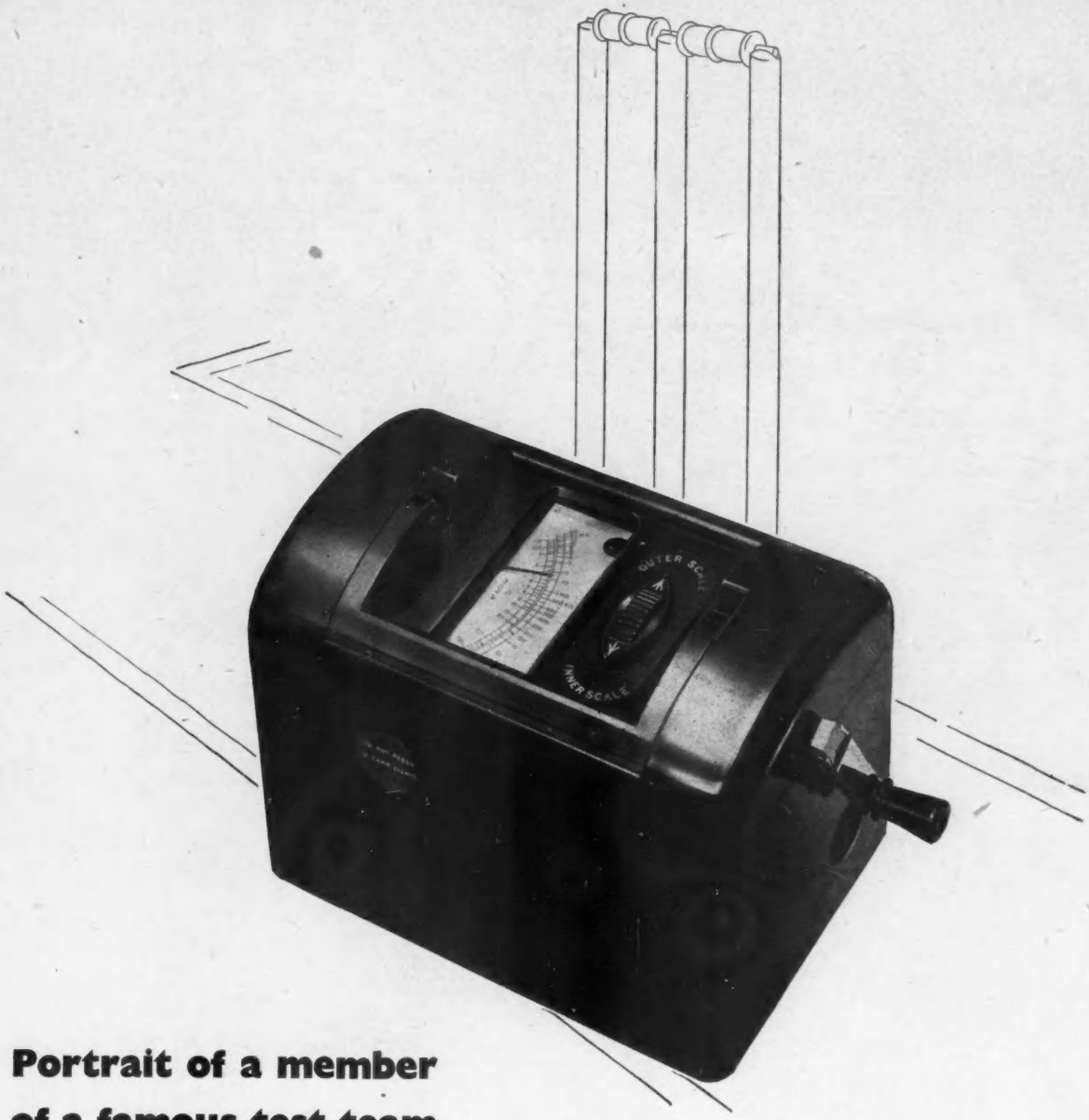

Portrait of a member of a famous test team

Why be caught out by faulty insulation or stumped by that insulation problem. By using a "Megger" Insulation Tester you can ensure that your equipment will have a good innings.

The Series 4 instrument, illustrated above, is the latest addition to the "Megger" range of insulation testers. Ideal for testing house wiring, portable tools, small motors and domestic apparatus. Insulation range 50 megohms at 500 volts — Constant pressure generator — Can be supplied with additional ohm scale for continuity tests.

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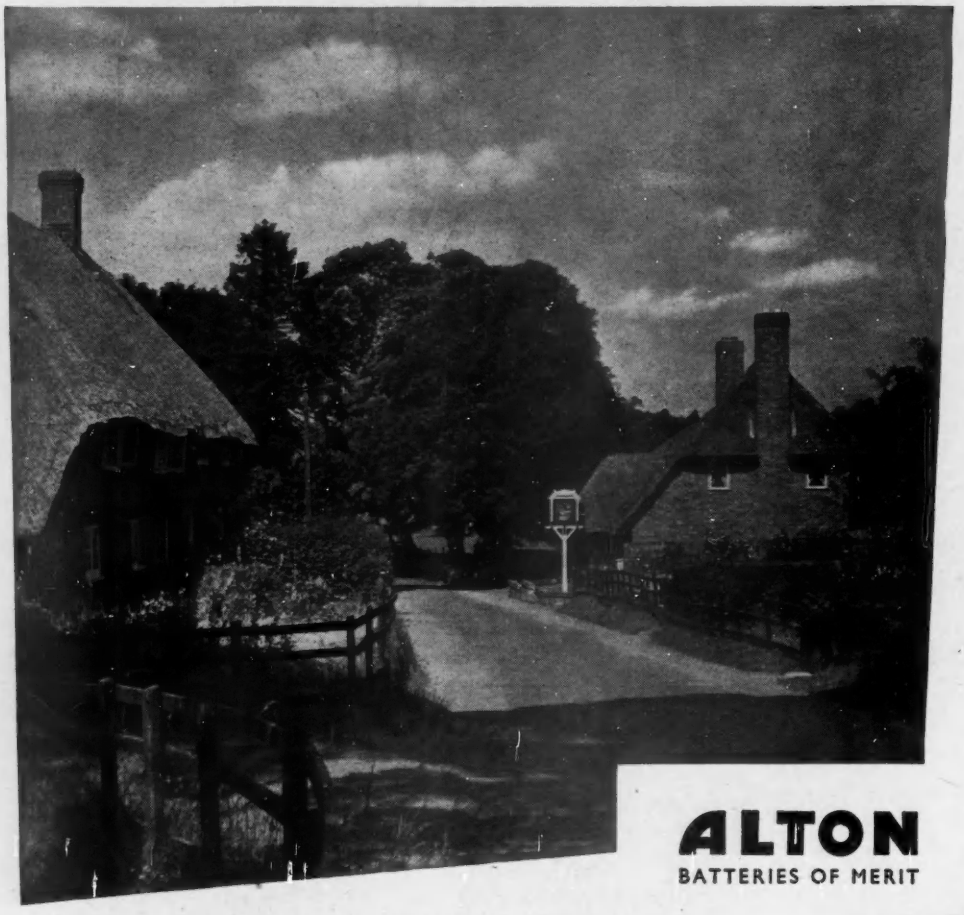

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Brighter streets—at Less cost

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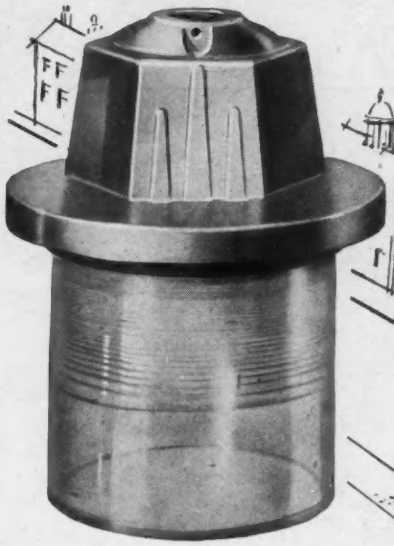

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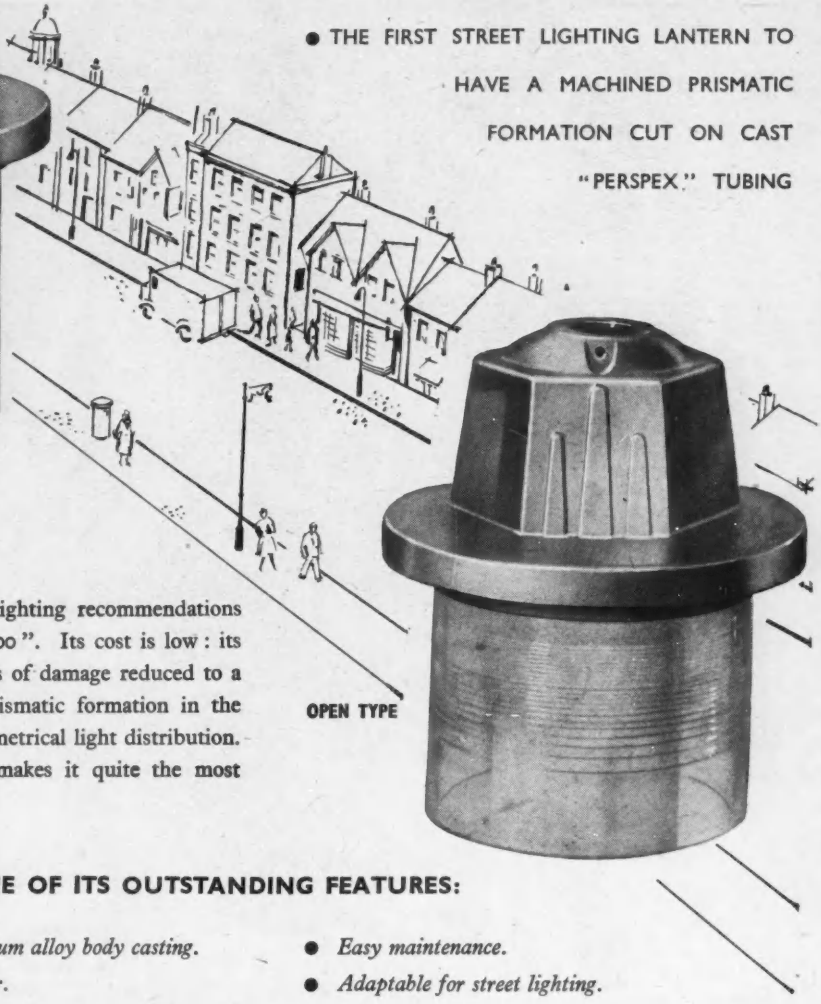

OPEN TYPE

BEFORE deciding on your street lighting recommendations you should see the "Universal 100". Its cost is low: its maintenance easy and the chances of damage reduced to a minimum. The machine cut prismatic formation in the "Perspex" refractor ensures symmetrical light distribution. In fact, its all-round efficiency makes it quite the most attractive proposition available.

HERE ARE SOME OF ITS OUTSTANDING FEATURES:

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- *Low initial cost.*
- *Less liable to damage.*
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- *Adaptable for street lighting.*
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- *Stairs.*
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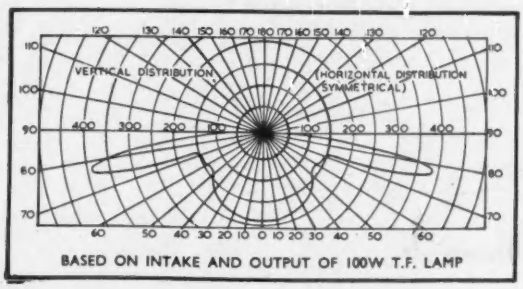

BASED ON INTAKE AND OUTPUT OF 100W T.F. LAMP

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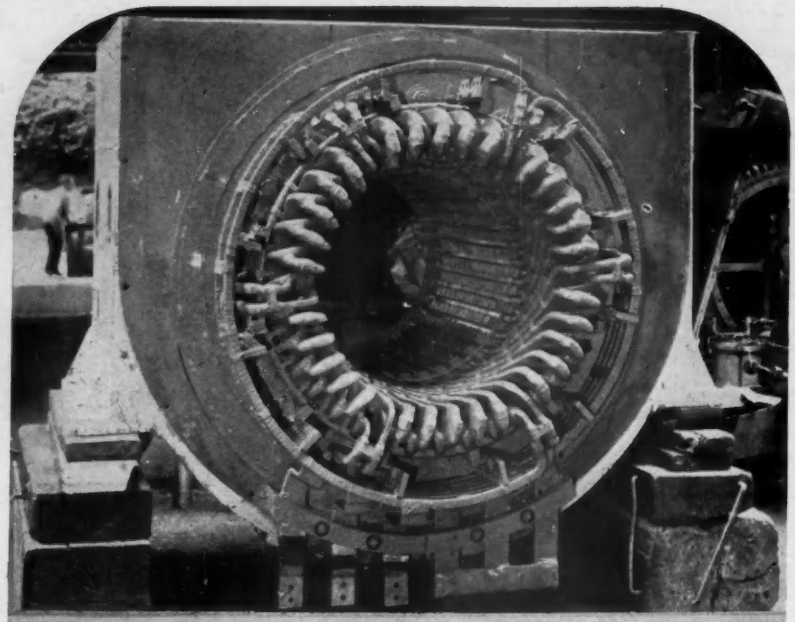

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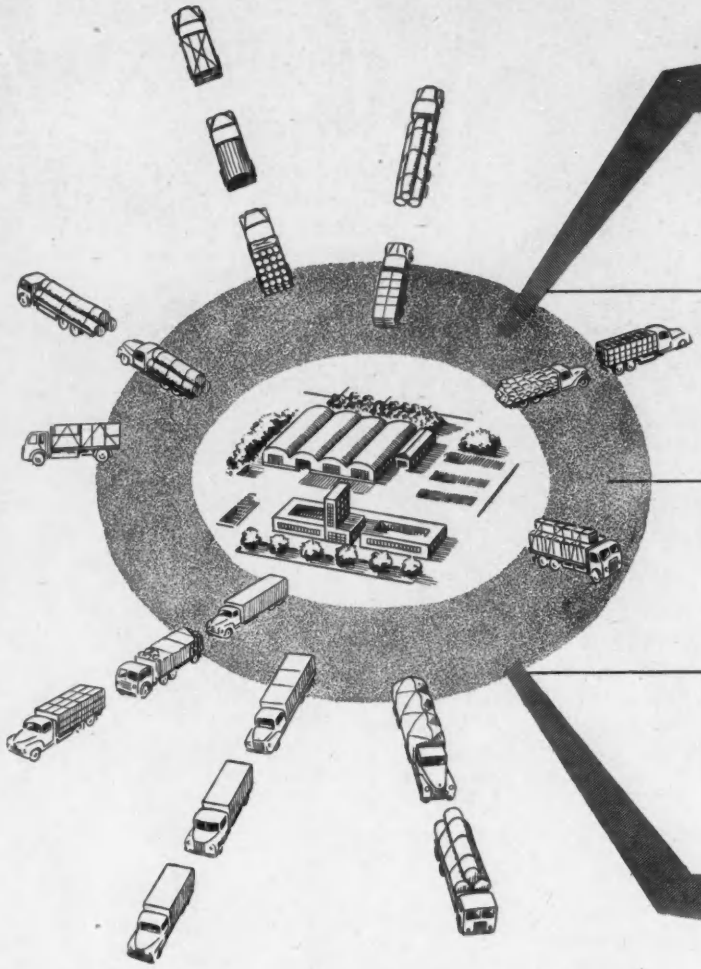

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to produce better goods in less time.
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to fit any need. Behind each specification of
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. . . research utilizing one of the most
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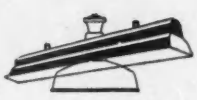
You can *rely* on a Benjamin lighting scheme.



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All detachable for easy cleaning. For easy maintenance — The Best

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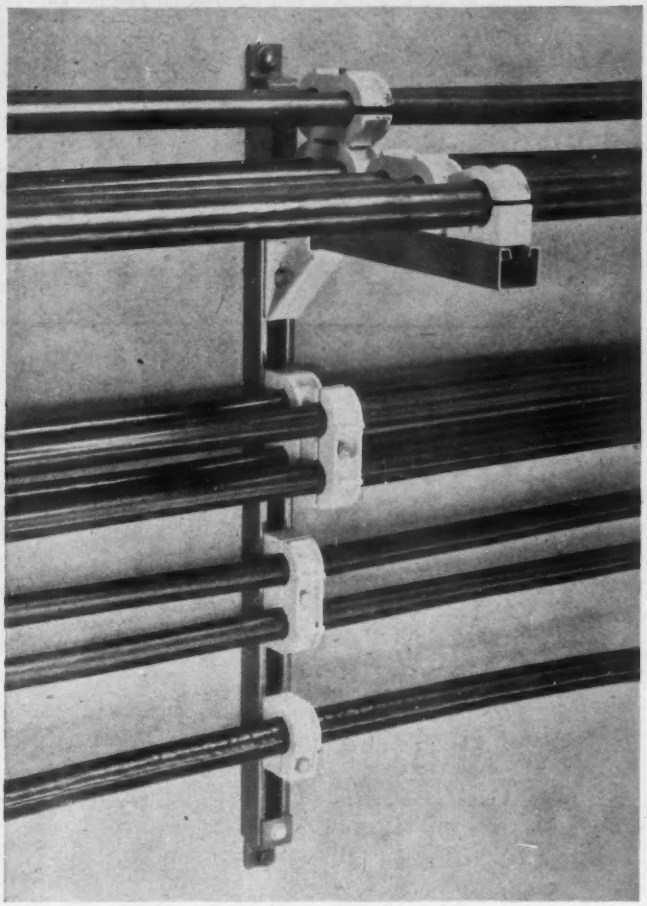
SPRINGFIELD 3318 · 3319 · 3310 MANUFACTURERS GRAMS · THORLUX · B'HAM

SIEMENS

SIERACK

A simple and speedy method of erecting steel fixings for supporting cables, etc.



NOTE THESE FEATURES

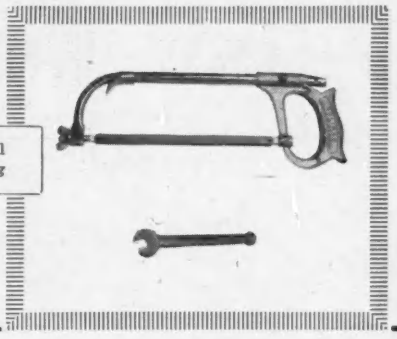
Layout can be planned on the job; no detail drawings or draughtsman required.

No holes to be drilled on site.

Can be placed on walls, ceilings or fixed to upright or overhead girders.

Finishes: black or green stove enamel, aluminium or galvanized.

Suitable also for conduits, fittings, pipes and a variety of purposes where supporting steelwork would normally be required.



These two tools will erect any Sierack Fitting

Descriptive Pamphlet No. 180 on application

SIEMENS BROTHERS & CO. LIMITED, WOOLWICH, LONDON, S.E.18

Telephone: Woolwich 2020, Ext. 282

REASONS

CHLORVAR III is a varnish which will withstand FIRE RESISTING CHLORINATED COOLING FLUIDS such as are now used in transformers.

COVAR I is a varnish which will withstand CUTTING OILS, ESTER-LUBRICATING OILS AND CHEMICAL FUMES. It is a perfect insulator under most stringent conditions.

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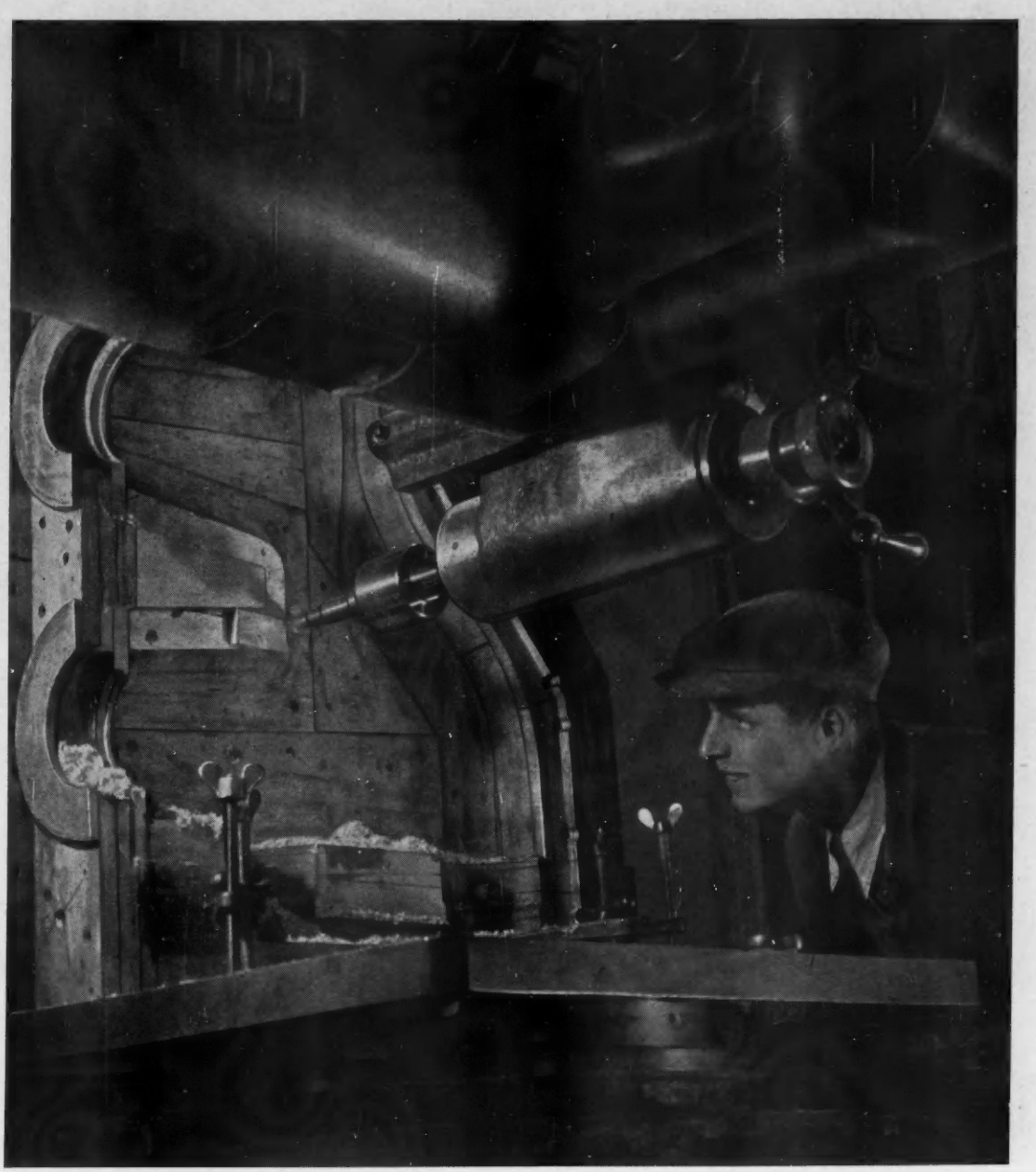
Telephone : TRA 0282/3/4 *Telegrams :* "Dielectric, Manchester"

London Office and Warehouse : 6 London Road, Brentford, Middlesex. *Telephone :* EALing 9152

A.867



A pattern for switchgear

Reyrolle

A. REYROLLE & COMPANY LIMITED · HEBBURN · CO. DURHAM

CW/2415/139

Each in its own place...

Fibre Board is STRONGER and LIGHTER

This small parts tray in trunk fibre board or vulcanised fibre is a boon to electrical component manufacturers. It can be obtained with fixed or removable partitions to hold variable amounts of small parts. Moreover, where female labour is used the lightness of fibre board for lifting and carrying will be appreciated by its users. The Enfield small parts tray is guaranteed to cut fatigue and muddle—this must result in a definite upward trend in production.

ENFIELD BOX COMPANY LIMITED

Queensway Enfield Middlesex Phone: Howard 1888 (2 lines)

MAN POWER

Time on the job enters into every stage of industrial production. Arrivals and departures, time on the bench or machine, breaks for meals and overtime are all related to cost of production.

GLEDHILL-BROOK Time Recorders provide the most adaptable means of recording regular or irregular hours on the job, automatically and accurately, every minute of every hour day and night.

With 8-day mechanical clock movement or electrical operation.

IS TIME POWER

Write for full information and illustrated leaflet to

GLEDHILL-BROOK TIME RECORDERS LTD
60, EMPIRE WORKS, HUDDERSFIELD

It's Moisture-Proof!

New METROVICK Fluorescent Lighting Fitting

This METROVICK moisture-proof fitting is specially made for use in laundries, textile mills, garages, paper-making plants and other places where water spray, steam or excessive humidity is encountered. The fitting is suitable for indoor or outdoor use. A two-lamp fitting is also available.

SPECIFICATION

Two water-tight auxiliary gearboxes cast in aluminium alloy house the 'instant-start' unit and the capacitor. Opal Perspex reflector. Watertight rubber lampholders.

Radio interference suppressor fitted. Fittings supplied complete with gear ready wired for connection to supply mains. Suitable for chain or conduit suspension.

Full information on request

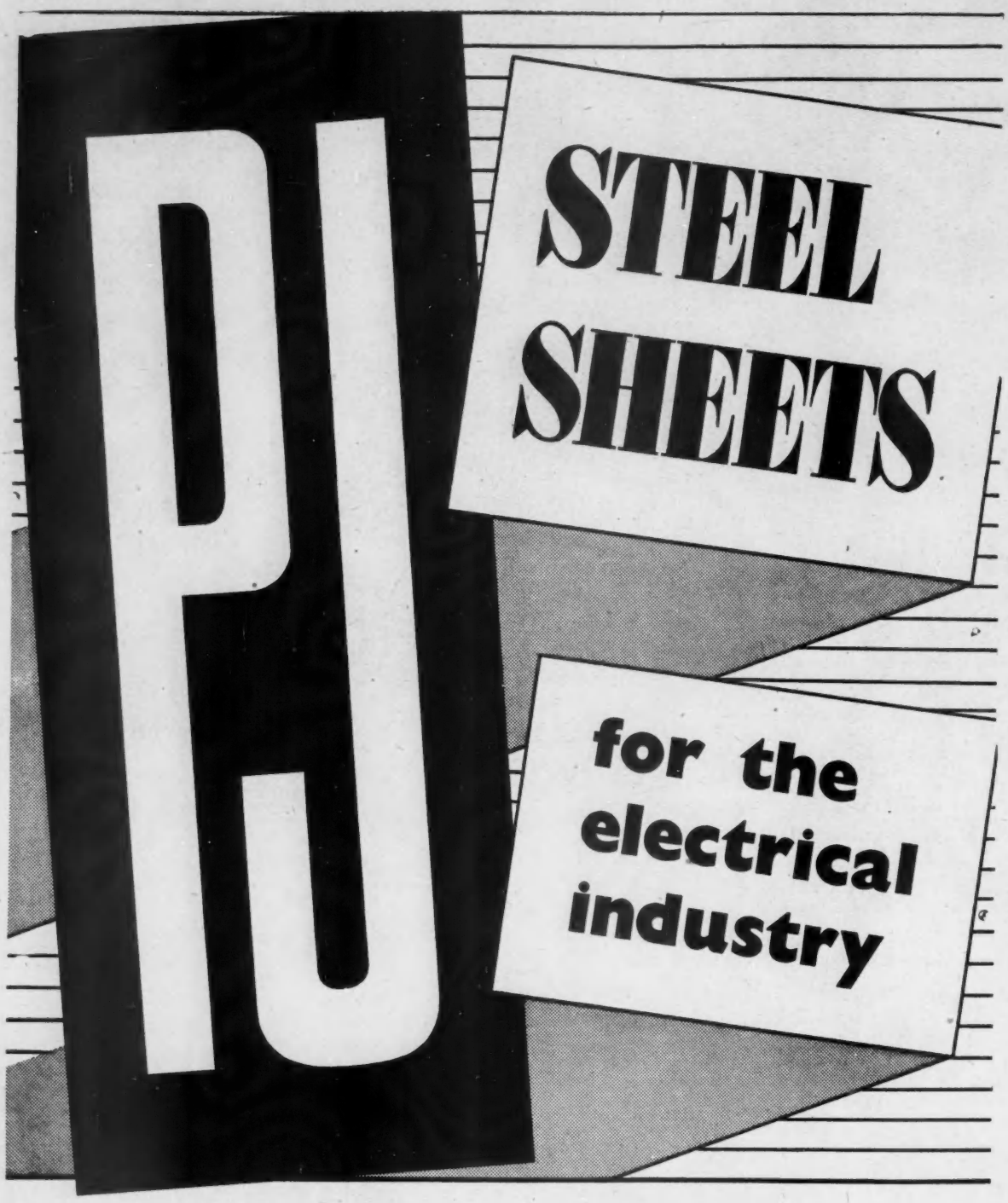
METROVICK

Moisture-proof Fluorescent Lighting Fittings

METROPOLITAN-VICKERS ELECTRICAL COMPANY LTD · St. Paul's Corner · 1-3 St. Paul's Churchyard · London E.C.4.

Member of the AEI group of companies

S/F405



PARTRIDGE JONES & JOHN PATON LTD

PONTNEWYNYDD NEAR PONTYPOOL

Telephone: Pontypool 131/2

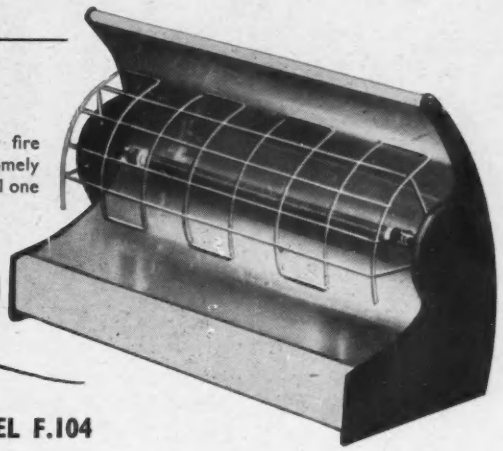
Three Fires by BNE

£7·17·1

MODEL F.103

A very good quality fire with an extremely efficient reflector. It is handsomely finished in black and ivory enamel, and has a switch to control one of its two rod type elements.

Dimensions : 16″ high ; 18¾″ wide ; 11½″ deep.
Loading : 2 kW. Price includes P.T.

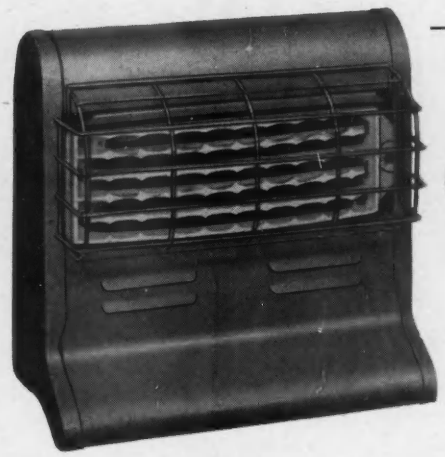


£3·8·4

A robust single-rod type reflector fire with a hard-wearing ivory and chocolate enamel finish.

Dimensions : 11½″ high ; 16⅜″ wide ; 7½″ deep.
Loading : 1 kW. Price includes P.T.

MODEL F.104



£2·14·8

MODEL F.101

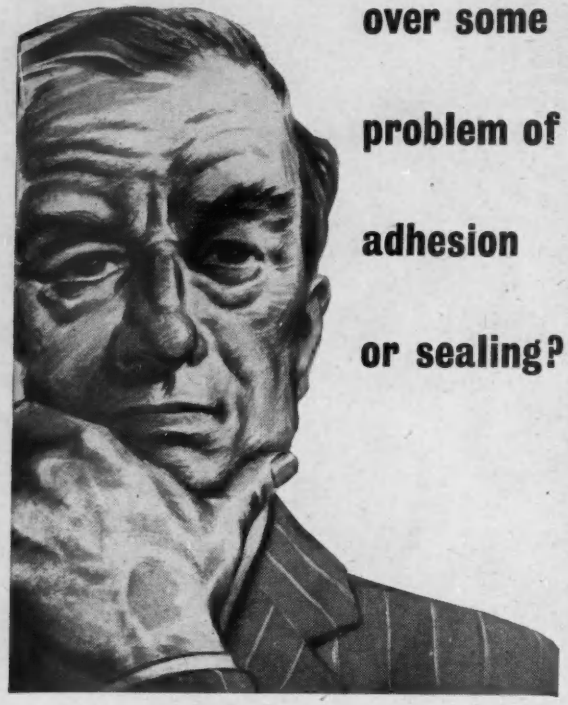
A sturdy general purpose fire of pressed steel construction, finished in florentine bronze.
Dimensions : 10½″ high ; 11″ wide ; 6¾″ deep.
Loading : 1 kW. Price includes P.T.
MODEL F.102 as above but 2 kW. **£3·18·7**

BRITISH NATIONAL ELECTRICS LTD.

Domestic Appliance Section of JOHNSON & PHILLIPS LTD.

NEWARTHILL · MOTHERWELL · SCOTLAND

Who has a headache



over some problem of adhesion or sealing?

There are problems of adhesion and sealing peculiar to the electrical industry. For example, weather-proofing electrical components so that they are absolutely water-tight and oil-resistant—and we do mean *absolutely*. Don't keep these problems to yourself when all the time there might be just the grade of BOSTIK Adhesive or PRESTIK Sealing Strip to save the day. Write to us. Tell us everything you feel we should know. Then leave the rest to us. We have a technical representative in your area who will visit you at short notice on request.

100 to 1 the remedy is

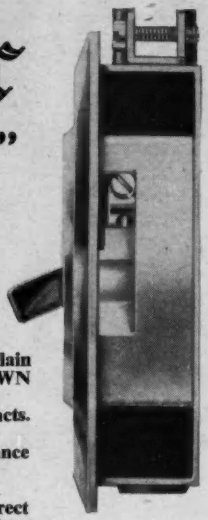
Bostik

ADHESIVES & SEALING COMPOUNDS

PRESTIK SEALING STRIP

'Bostik' is the registered trademark of
B. B. CHEMICAL CO. LTD., Ulverscroft Road, Leicester, *to whom all enquiries should be addressed.*

Tucker "FIVE-EIGHT" PLASTER DEPTH SWITCHES



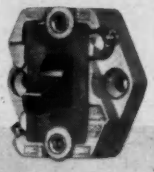
Outstanding Features:

1. Switch base is of English Vitreous Porcelain —STILL THE WORLD'S BEST KNOWN INSULATOR.
2. Short Slow Break action with silver contacts.
3. Can be operated without noise.
4. Moulded switchplates of slim appearance on wall surfaces.
5. Wood or Steel plaster depth boxes.
6. Steel alignment straps ensuring correct alignment with switchplate and wall surface irrespective of box depth.

Tests

Stringent tests showed no breakdown after 250,000 movements without load and over 100,000 complete operations on full load. Stock specimens successfully dealt with overload at 100% excess current and 60% excess pressure.

When used in conjunction with BS.1299 boxes the TUCKER STEEL ALIGNMENT STRAPS with elongated fixing holes ensure adequate rotational adjustment of the switch and plate in relation to any box which may not have been installed squarely in the wall.



Note exceptional rotational adjustment provided by elongated slots in alignment strap.

Ask for Folder Ref. G.57

Tucker TELAC

J. H. TUCKER & CO. LTD.
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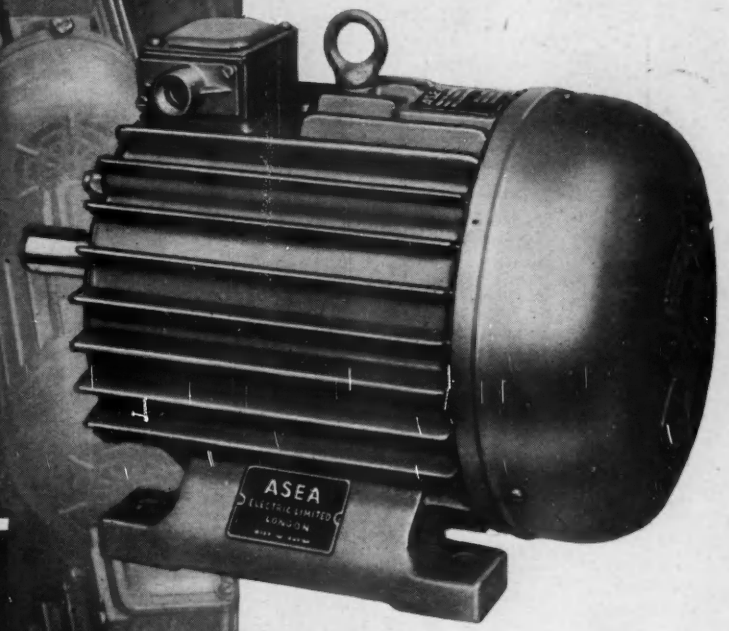
THREE PHASE MOTORS

Our range of three-phase Motors type MBB incorporate in their design and construction the experience gained by ASEA in the manufacture of high-grade electric motors for more than seventy years. The motors have a number of desirable features including the following:

1. Low in price—yet high in quality. 2. Sturdy—yet light in weight (a 1h.p. 1,400 r.p.m. motor weighs only 33 lb.). 3. Unusually compact design. 4. Efficient performance. 5. Tropical Insulation. 6. Temperature rise complying with BSS 168/1936. 7. Attractive finish

SPECIFICATION AND DETAILED DIMENSIONS ON REQUEST
DELIVERY EX STOCK



ASEA

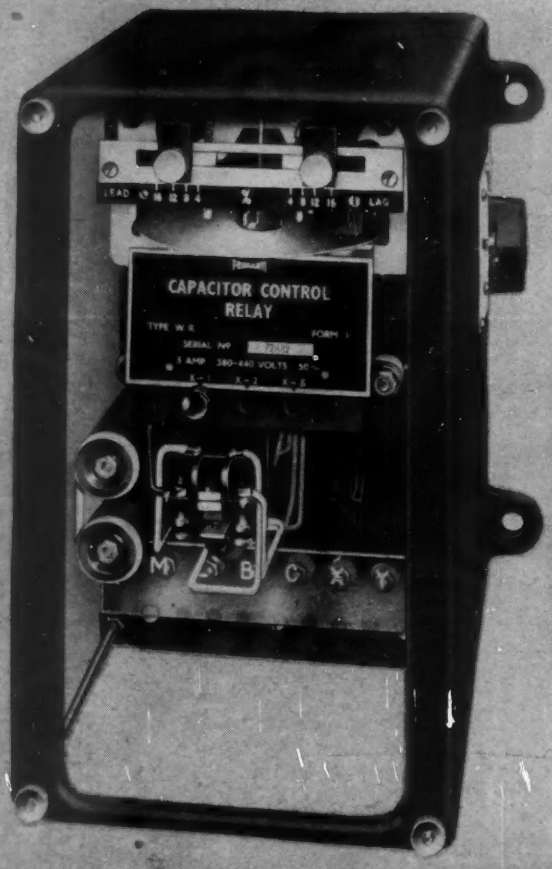
ASEA ELECTRIC LTD. *Associated with Fuller*
Electrical & Manfg. Co. Ltd., Fulbourne Rd., Walthamstow, London, E.17.
Phone: LARkswood 2350 (10 lines)
ALSO AT: BIRMINGHAM : GLASGOW · MANCHESTER : DUBLIN

FERRANTI

CAPACITOR CONTROL RELAY

(TYPE WR)

FOR SINGLE STAGE CONTROL



This relay provides *automatic power factor correction* when used with suitable capacitors.

- Independently adjustable "lead" and "lag" settings over a wide range.
- Self-contained auxiliary element with substantial contacts to operate the heavy duty capacitor contactor.
- Selector switch to give automatic or manual control as required.

Installation of capacitors and contactors controlled by Type WR Relays.

FERRANTI

FERRANTI LTD · MOSTON · MANCHESTER 10

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ELECTRIC CLOCKS · ALWAYS RIGHT ON TIME

F.L. 137

This is right up your street

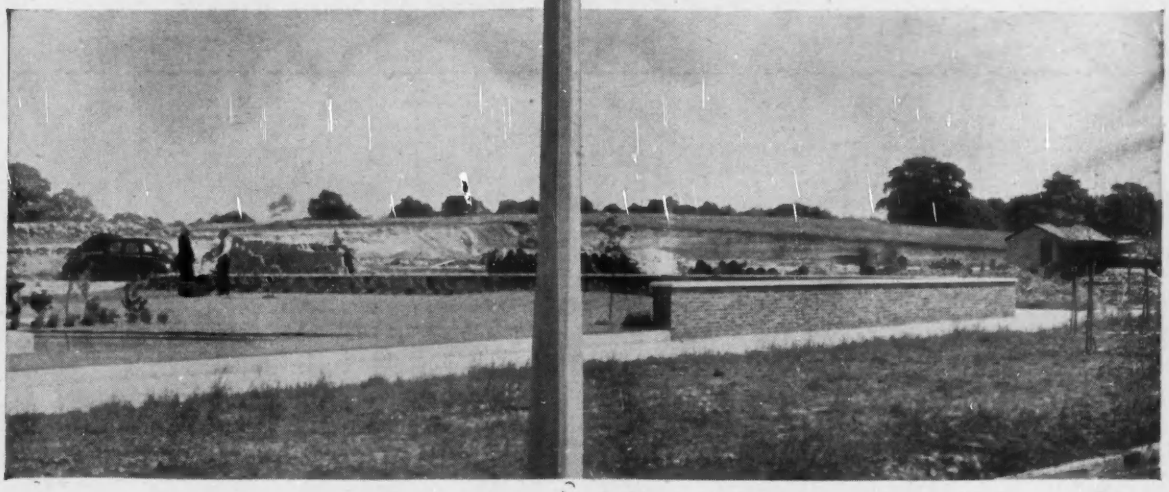
Crompton street lighting offers the latest concept in clean, elegant design, at the same time giving full, economical illumination of public highways.

Crompton LIGHTING

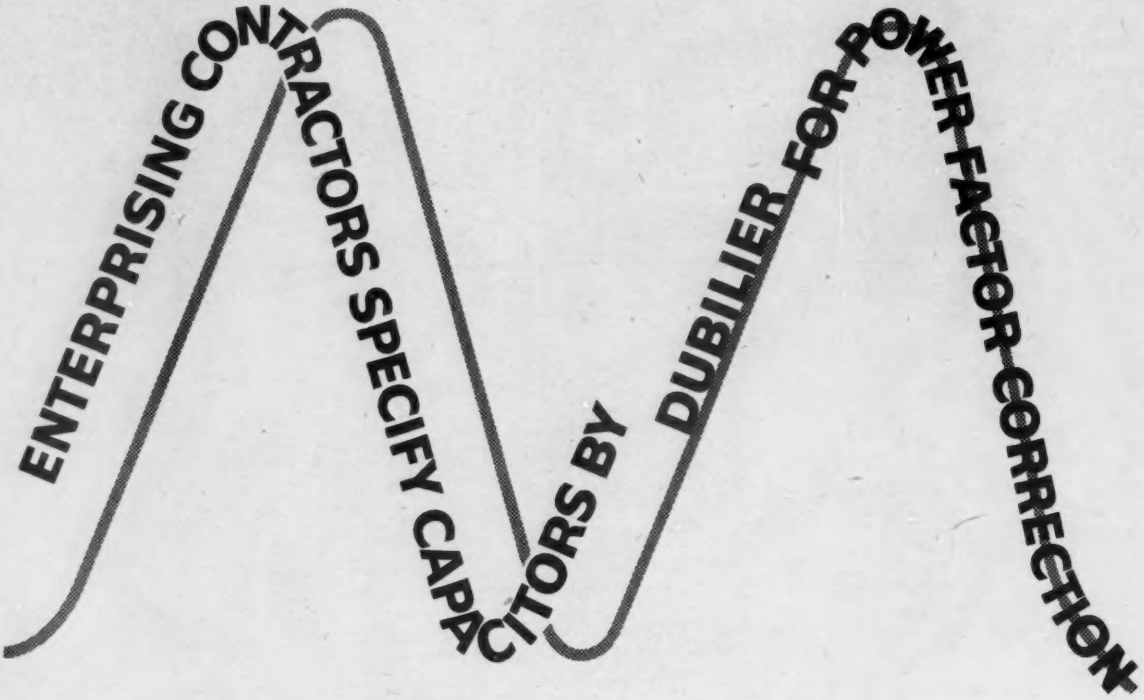
ELECTRICAL EQUIPMENT

BY APPOINTMENT MANUFACTURERS OF ELECTRIC LAMPS TO THE LATE KING GEORGE VI CROMPTON PARKINSON LTD.

Crompton 'Concept 2' with Stanton 8F Column for main road sodium lighting



CROMPTON PARKINSON LTD · CROMPTON HOUSE · ALDWYCH · LONDON, W.C.2. TEL: CHANCERY 3333

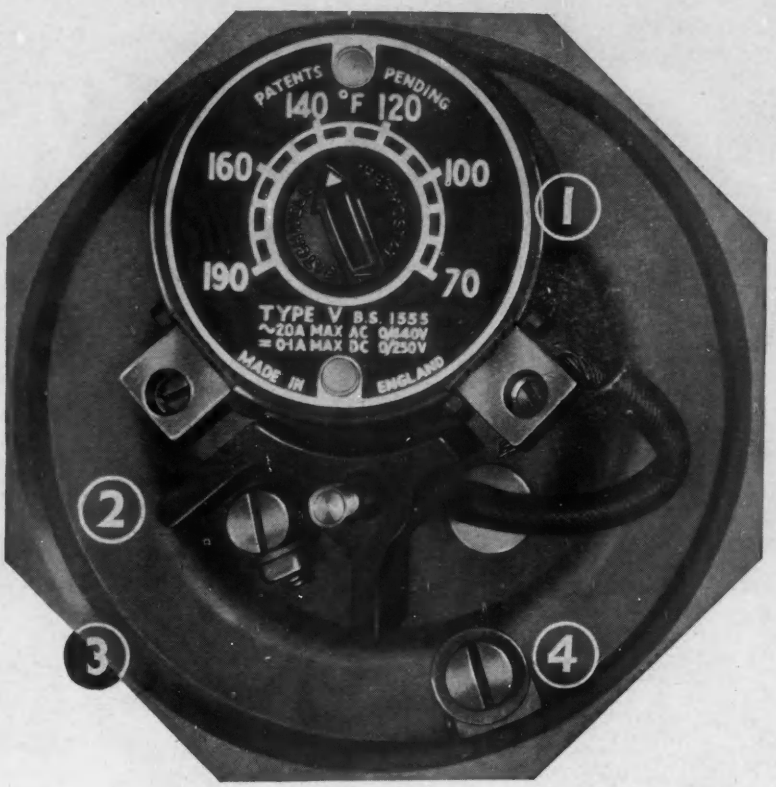


DUBILIER

Dubilier Condenser Company (1925) Ltd., Ducon Works, Victoria Road, North Acton, London, W.3

Phone : ACOrn 2241 (5 lines). Gram : Hivoltcon Wesphone. London Marconi Inter Code

DN 113



WIRING MADE EASY . . .

The G.E.C. now have a new range of Immersion Heaters with these easy-to-wire features:

1. Thermostat cannot rotate in head.
2. Phase and neutral wires separated by barrier.
3. Shortest possible wire route inside head.
4. Bare earth wires can enter via slot in cover.

The sizes available range from 12in. to 30in. suitable for either vertical or horizontal mounting. Prices from 47/3 (Purchase Tax 17/3 extra) for the 3kw. 12in. model. Thermostat 28/10 extra.

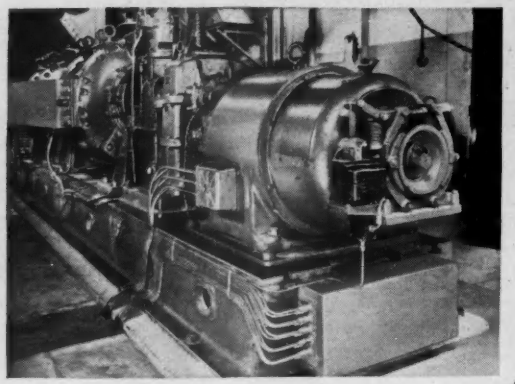
New G.E.C. IMMERSION HEATER

The General Electric Co. Ltd., Magnet House, Kingsway, London, W.C.2.

A BIG NAME

...two in fact!

The name Rolls-Royce is universally synonymous with the highest standard of quality and performance. These same characteristics prompted this famous British concern to choose 'Pyrotenax' Cables for the wiring of its aero-engine test-bed equipment. 'Pyrotenax' copper covered, mineral insulated cables are essentially fire resistant, immune from the effects of oil, water and corrosion. Being entirely inorganic they are virtually indestructible, and require no maintenance.



A non-technical description of 'Pyrotenax' is given in our booklet "Current Carrying." For the technical man "Technical Data" is available—write for your copy.

PYROTENAX LIMITED, HEBBURN-ON-TYNE. Phone: HEBBURN 32244/7

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Phone: Abbey 1654/5
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Phone: Midland 1265
MANCHESTER
Phone: Blackfriars 6946
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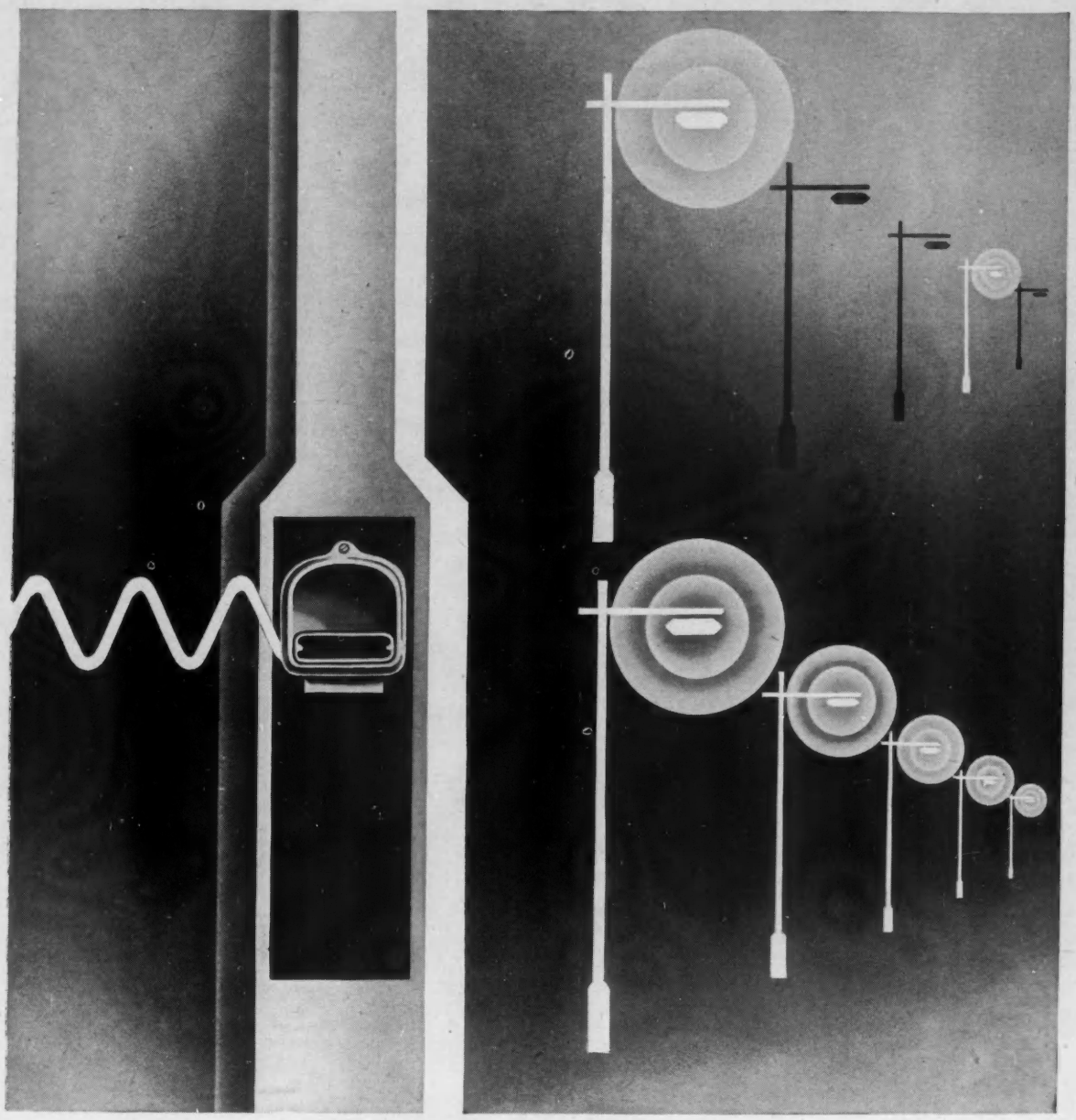
Phone: Central 2238

The use of the trade name 'Pyrotenax' is exclusive to the products of this Company and its associates

current events

Pyrotenax
COPPER COVERED MI CABLES

GD5



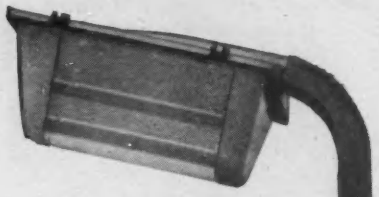
STREETS AHEAD

When planning a lighting network the engineer is naturally anxious to supply the community with the finest equipment available. A control system is part of the lighting plan and for the engineer who wants a system always under his personal control, without any worries about supply interruptions. " Rythmatic " ripple control offers the following advantages:—

★ The operation of the control switches is not interfered with by the temporary interruption of the electricity supply.
★ Centralized push-button control.
★ Multiple signals for all-night, half-night, prior-dawn switching.
★ Control switches fit most housings.
★ Control switches need virtually no maintenance.
★ For the services available " Rythmatic " is the most economical form of control.
★ Signals are available at any time, day or night.

RYTHMATIC RIPPLE CONTROL EQUIPMENT

ATM AUTOMATIC TELEPHONE & ELECTRIC COMPANY LIMITED
LONDON AND LIVERPOOL
AT3861-A

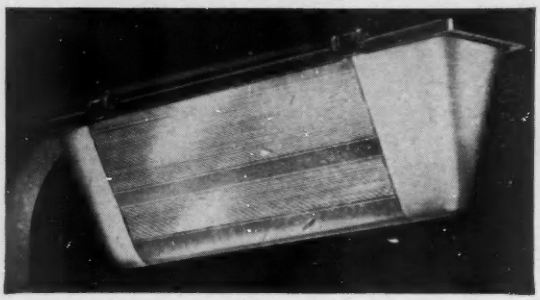


NEW 'PERSPEX'

STREET LIGHTING LANTERN

FOR CRAWLEY NEW TOWN

The new street lighting lantern manufactured and supplied by The Edison Swan Electric Co. Ltd. and installed in the new town at Crawley has a clear 'Perspex' bowl with opalised ends. The light distribution is controlled by two machine-cut 'Perspex' refractor plates sealed to the inside of the bowl on either side of the lantern.



'Perspex' is the registered trade-mark for the acrylic sheet manufactured by I.C.I.

ICI

IMPERIAL CHEMICAL INDUSTRIES LIMITED
LONDON, S.W.1

FP.28

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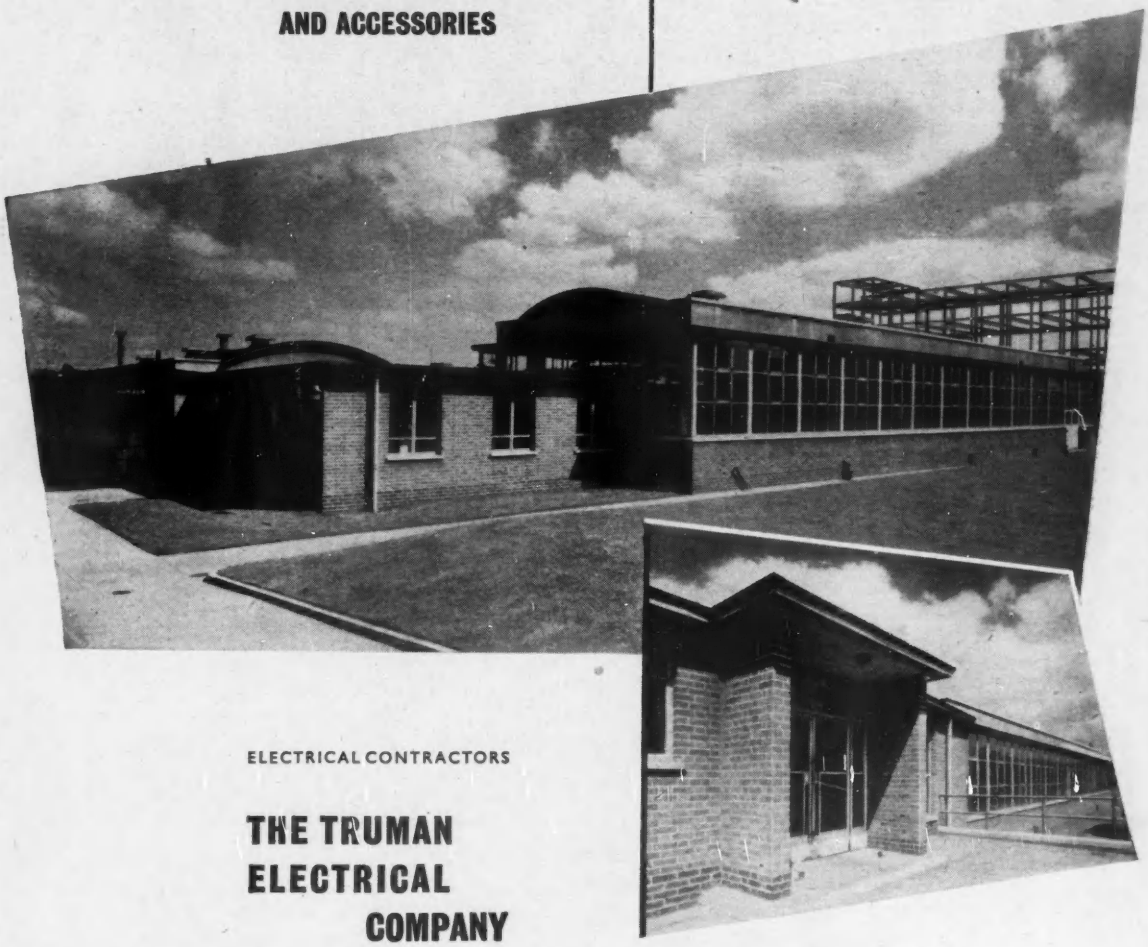
Walsall

CONDUIT
CONDUIT FITTINGS AND ACCESSORIES

WALSALL NEW TECHNICAL COLLEGE WORKSHOP BLOCK

JOINT ARCHITECTS:
A. C. H. STILLMAN, F.R.I.B.A.
COUNTY EDUCATION ARCHITECT
WITH
Messrs. HICKTON, MADELEY & SALT, A.R.I.B.A.



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THE TRUMAN ELECTRICAL COMPANY

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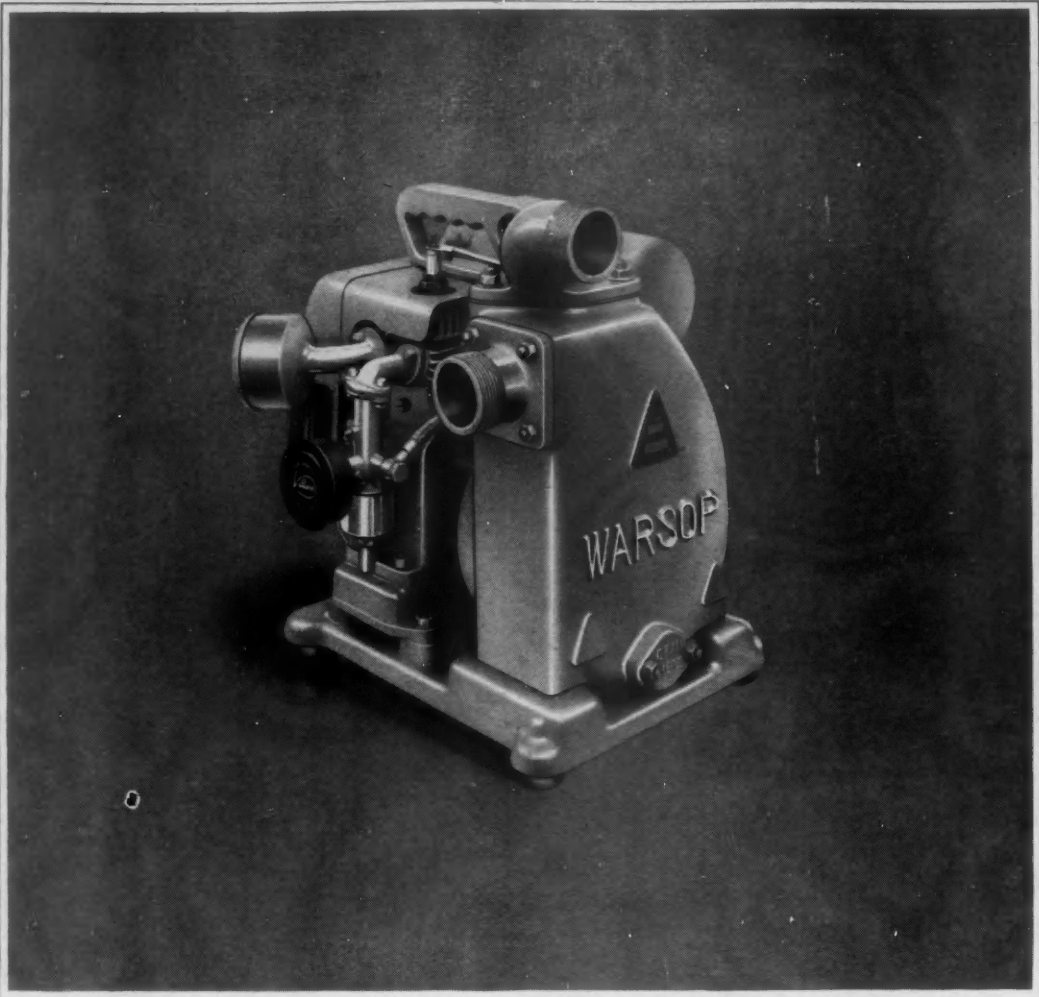
WALSALL CONDUITS LTD · EXCELSIOR WORKS · WEST BROMWICH



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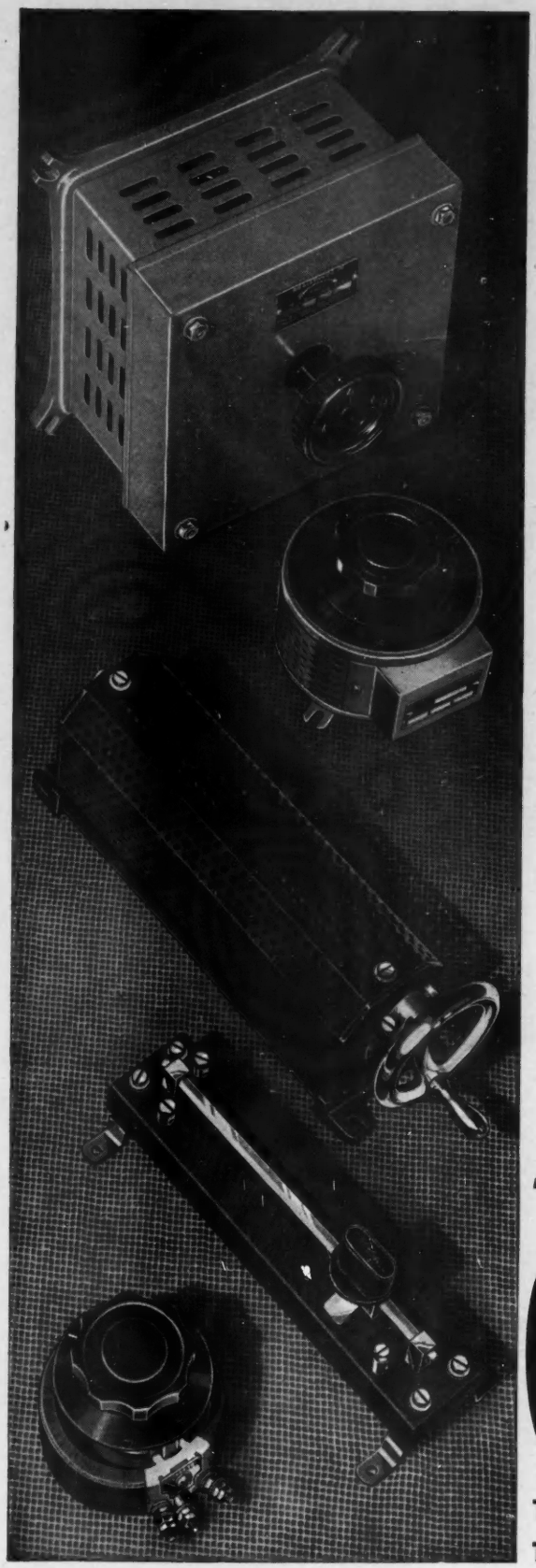
WARSOP
PORTABLE POWER TOOLS

ALSO MANUFACTURERS OF THE NEW WARSOP S7 CONCRETE BREAKER
WARSOP HD ROCK DRILL AND WARSOP BENJO RAMMER

WARSOP POWER TOOLS LTD · 27 REGENT STREET · LONDON · S.W.1 · REGENT 4632



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Asbestos Woven Resistance Grids
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* * *

Asbestos Woven Heating Nets
Air Heaters, Electric
Cartridge Heater Units
Heating Elements wound on Mica, Porcelain, Asbestos
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...and you think of

CRESSALL

THE CRESSALL MANUFACTURING CO. LTD.
TOWER STREET, BIRMINGHAM 19

WESTALITE

VEHICLE CHARGERS

THE POWER BEHIND EFFICIENT BATTERY ELECTRIC TRANSPORT

Installation of Westalite Chargers for Electruks at the Woodford Depot of the London Co-operative Society Ltd., by whose permission this photograph is reproduced.

Eliminate battery failure. Install chargers that comply to all specifications laid down by battery manufacturers — Westinghouse WESTALITE vehicle chargers. They provide correct taper charging conditions at all times; with automatic cut-out by means of a relay on completion of charge.

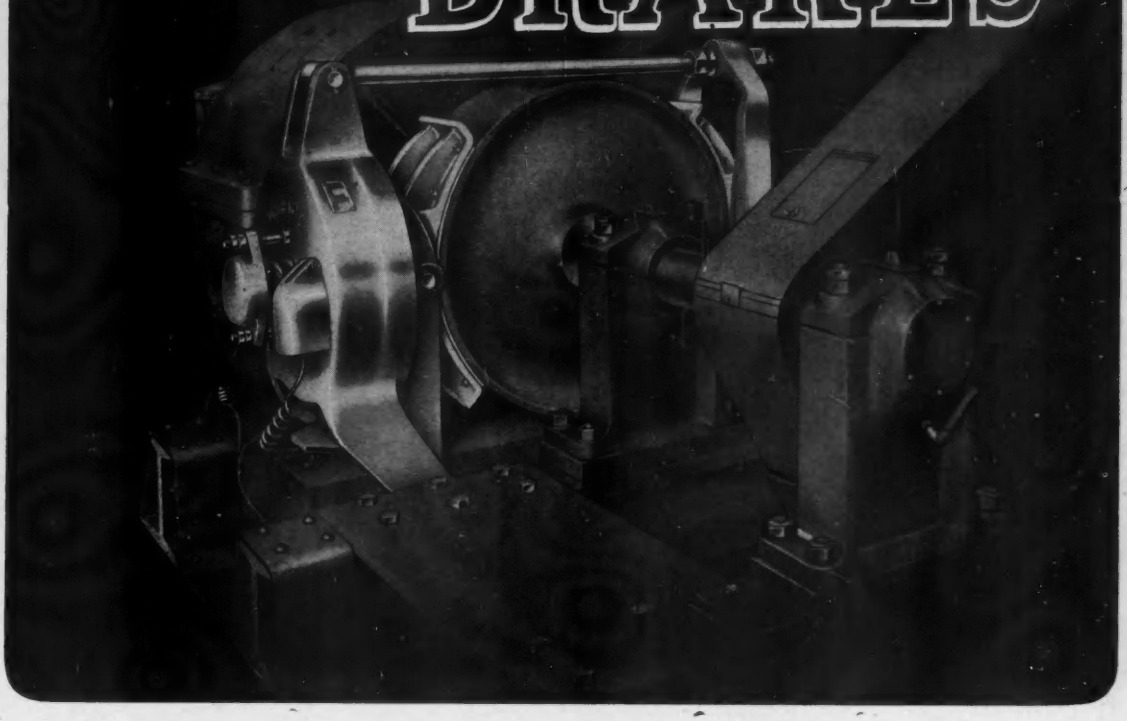
The WESTALITE charger range is extensive and models are available for all sizes of traction batteries of either the lead acid or alkaline types.

WESTALITE chargers are static in operation and therefore require no maintenance and with the high efficiency double-voltage rectifiers incorporated running costs are reduced to a minimum.

For full details of performance and range write for Data Sheet No. 831 to Dept. E.T.21

WESTINGHOUSE BRAKE & SIGNAL CO. LTD., 82 YORK WAY, KING'S CROSS, LONDON, N.1

MAGNET OPERATED BRAKES



Simple design — robust construction — easy adjustment — low maintenance and an unrivalled reputation for efficient and dependable service. These are reasons why you will find IGRANIC TYPE 'M' Brakes installed wherever quick positive braking is necessary.

The range of sizes available covers brake drums from 8" to 30" diameter suitable for motors up to 350 h.p. D.C. (or A.C. with rectifier). Also available are Electro-Hydraulic and Hydraulic patterns.

Full particulars of these Brakes and other Igranic Electro-Magnetic devices can be obtained on application to Publicity Department, Bedford, or any branch office.

IGRANIC ELECTRIC CO. LTD.

HEAD OFFICE AND WORKS BEDFORD

MOTOR IGRANIC CONTROL

LONDON · BIRMINGHAM · BRISTOL · CARDIFF
GLASGOW · LEEDS · MANCHESTER · NEWCASTLE · SHEFFIELD

(One of Metal Industries group of companies)

Connollys have never been checkmated or even checked in their steady progress as one of the world's leading manufacturers of winding wire.

Checks however, do take place—stringent quality checks—enabling Connollys to build up a fine reputation amongst discriminating users.

Their Conymel wire (vinyl acetal coated to B.S.S. 1844) has a world wide reputation as being the best of its type and Connollys are one of the largest manufacturers of this wire in the British Empire.

CONNOLLYS *Winding Wires*

CONNOLLYS (BLACKLEY) LIMITED

Kirkby Industrial Estate, Liverpool

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Nothing left to chance . . .

CAP AXIALITY

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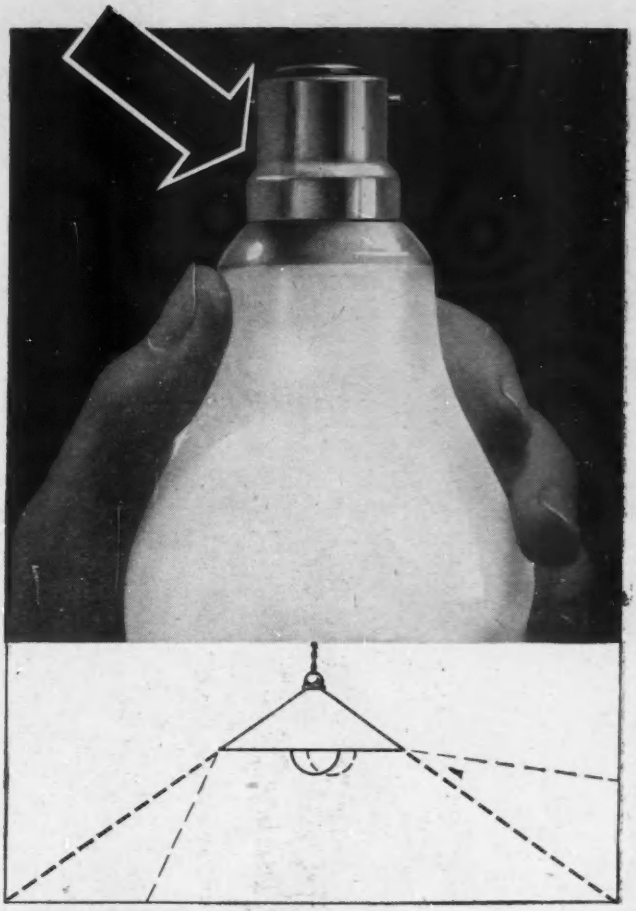

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SUBSCRIPTION RATES

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MISUNDERSTOOD AUTHORITY

Political scoring points were not wholly absent from last week's House of Commons debate on the 1953-54 Gas and Electricity Boards' reports, but they were sufficiently infrequent to permit the debate to serve the useful function of showing where "popular" misunderstandings exist. The Government had little to announce on this occasion apart from a renewed promise of support for initiative, and the Opposition had no strongly felt criticisms to offer. As a result, the debate took no clearly defined direction, but wandered broadly over its whole subject. It left the impression, so far as electricity supply is concerned, that M.P.s are becoming reasonably informed about the problems, policies and achievements of their own area boards; discussion here was, on the whole, intelligent and helpful. When the Central Authority was mentioned, however, misunderstanding was rife, except in the speeches of a very few members who have made themselves specialists in this subject. There is hope for some improvement when next the House embarks on similar debate, for by then the promised Select Committee on the Nationalised Industries will be in existence, and its members may be able to give the House a lead on the lengthy reports and accounts, concerning which Mr. Robens, the principal Opposition spokesman in the debate, regretted "none of us has the time in this busy life to examine them in detail." Certainly a more intelligent approach will be welcome, for the misunderstandings revealed last week are not without some danger for the supply industry.

THE PRICE OF HEAT

District heating, combined with electricity generation has long been regarded as a most effective method of saving fuel, and now when coal conservation has become a problem, the system has been widely advocated, often by those who fail to appreciate its limitations. From a theoretical aspect, at least, there is much to be said in favour, although economically several difficult points arise, particularly in the apportioning of capital costs between heat production and generation, and also in finding a logical basis for charging operational, maintenance and fuel costs. In addition there is the ever-vexed problem of assessing the heat requirements of individual houses or flats. In the latest British scheme installed at Pimlico these problems have not been entirely solved to the users' satisfaction. This is shown by the complaints made to Westminster City Council by the Churchill Gardens Tenants' Association which alleges, among other matters, that the

charges are too high, and that tenants have had to install electric fires to make up for the deficiencies of the system. The use of fires in this manner is most significant as it has always been deprecated as providing the electrical industry with a difficult and uneconomic load. Information on the extent to which electric fires are being used and the reasons why they need to be used by the tenants have not yet been given. For long has a comprehensive report on the Pimlico scheme been awaited as a guide to the economic potentialities of district heating, and it is regrettable that no information on the subject has yet been forthcoming.

JUBILEE OF THE VALVE

This week, fifty years ago, Ambrose Fleming filed the master patent of the thermionic valve, and thus a device was born, which in its further development has revolutionised the life of the civilised world. In his personal report to Marconi, Fleming remarked "I have not mentioned this to anyone as it may become very useful." How useful it was to be even he could scarcely have imagined. The brilliance of Fleming's invention lay not so much in the discovery of emission from a hot filament —a phenomenon which had been investigated and noted both by Fleming and Edison some 20 years before, and for which a theory had been formulated by Sir J. J. Thompson in 1899—but in the application of electron emission to the rectification of high frequency wireless currents. The subsequent introduction of the grid of Dr Lee de Forest, and later of auxiliary electrodes by other workers, extended the application of the valve immeasurably, and it became the foundation of the vast radio and electronics industry of today. It is perhaps a little ironic that the Jubilee of the valve should fall at a time when the transistor, a possible successor in many of its hitherto exclusive fields, is coming rapidly to the fore. Yet the ancestor of the transistor — the cats-whisker crystal, discovered by H. H. C. Dunwoody in 1906—has a history well-nigh as long as the valve itself.

AFTER THE FAIR

From all reports, the ambitiously organised British Trade Fair at Baghdad secured a success surpassing all expectations. In the orders that will follow directly and indirectly from this experiment, the electrical industry in all its branches can expect to share; so it behoves electrical manufacturers to pay attention equally to the lessons that have been learned from the examination of the Middle East market that has accompanied the staging of the Fair. One factor is the unexpected demand for consumer goods: a middle class is developing more strongly and more rapidly in the oil countries than had been expected. Yet even allowing for this, it is technical products that will be most required in coming years, and here the outstanding need revealed is for more attention to customer requirements and preferences. Reports have repeatedly pointed out that without this, advantages of quality and price may fail to produce repeat orders, and they have stressed the greater care given by Continental competitors to such business details. There is a direct warning about German selling from this aspect in the review of the Fair's success given last week by Sir Harry Pilkington, President of the Federation of British Industries. As stressed before in these columns, electrical equipment needs to be prepared more carefully for long journeys, and the customer must be kept informed in more detail of its progress from the placing of the order to delivery, if the fruits of the Baghdad Fair and other overseas enterprises are to be fully garnered.

TIME IS THE ESSENCE

Time is the essence of any maintenance scheme which has progressed beyond the crude basis of "repair on breakdown." Experience usually suggests that some convenient period, a month or a year, between inspections will ensure that deterioration has not proceeded too far to permit fairly simple preventative action; and a scheme is readily drawn up to bring a reminder when such inspections are due. Yet in the last analysis almost all such schemes are basically unsound. It is time of running, number of revolutions, number of starts and similar considerations that determine when maintenance is needed; not mere hours of installation. Any scheme based on standing time must carry a large factor of safety to take care of unexpectedly frequent operation, and occasionally this can prove unacceptably expensive. Such cases are comparatively rare, but they need to be borne in mind by the plant engineer. The solution when they occur is simple enough: a revolution summator or some form of integrating time meter, fitted to the machine concerned, permits a closer approach to the "every 5,000 miles" kind of criterion familiar enough with cars, providing a logical foundation for maintenance.

ELECTRICITY IN CHURCH

Heating a church is an awkward problem for architects and engineers. Technical difficulties inherent in large volumes and widely varying occupancy are the harder to solve because of the necessarily high aesthetic standards that apply in such buildings, severely restricting the permissible siting of heating appliances. There is a helpful discussion of possible solutions in a pamphlet recently published for the Central Council for the Care of Churches: solid fuel, gas and electricity all have their advantages, but neither of the alternative choices can vie with electricity in ease of matching with existing church decoration, nor in needing so little attention to give satisfactory operation. Electrical heating is rightly recognised in the pamphlet as "offering great possibilities for church heating," though there are some words of warning about its application. One important appliance, however, is ignored in the electrical section. The Council damns electricity for continuous heating, but omits all mention of the storage block type of heater. Some successful church installations already stand to the credit of this relatively new technique, and it has particular attractions where continuous heating is required. Since clergy and churchwardens will be guided largely by the present pamphlet, a reminder of this extra electrical possibility should not be neglected by local contractors and area boards when a church is known to be reconsidering its heating arrangements.

CROSSING G.P.O. LINES

By careful design, the use of shorter insulated spans simplifies power line construction

By a Distribution Engineer

UNTIL about eighteen months ago the only accepted means of protecting P.O. lines at h.v. power line crossings were either under-grounding of one of the lines or the provision of a cradle guard. Then, in memorandum E-in-C 231B the Post Office agreed to insulate P.O. lines at the point of crossing where the power line voltage did not exceed 33 kV between phases.

More recently, in an addendum to the above memorandum the P.O. has made a further concession which permits the insulating of the power line conductors where the power line voltage does not exceed 11 kV r.m.s. between phases, or 6·6 kV r.m.s. to earth. The insulation is to be p.v.c., manufactured and applied in accordance with a Post Office specification by an approved manufacturer, and having a minimum thickness of 60 mils. Among other conditions is the requirement that the factors of safety laid down in the Ministry of Fuel and Power Regulations El.C.53, 1947 Revise shall be maintained for the crossing span and supports.

It will be appreciated that one very considerable advantage of this concession is that, where insulating the power line conductors is adopted as the means of protection, the work is in the hands of the Electricity Board concerned, and delays in commissioning the line should be avoided.

It is the purpose of this article to discuss how the stipulation regarding the factor of safety for the insulated conductors can be met.

It may be supposed that this requirement can only be met either by placing a section pole with in-line stays at either end of the crossing, or by using a conductor having a higher tensile strength in the crossing span.

It can be shown, however, that this is not necessary and that the required condition can be met by shortening the crossing span. The maximum permissible length of crossing span bears a fairly definite relationship to the equivalent span of the section in which it falls. The precise relationship depends on the erection temperature, but as this is not critical, a sufficiently close approximation can be achieved over a range of erection temperatures covering those likely to be encountered in this country.

Typical Calculation

Considering first an 0·05 sq in. copper line erected to B.S. 1320, the appropriate data are weight of bare conductor 0·2 lb/ft and diameter 0·317 in. Taking the weight of p.v.c. as 90 lb/cu ft then the covering weighs

$$\pi(0{\cdot}317+0{\cdot}06)\,0{\cdot}06\times 90/144=0{\cdot}044 \text{ lb/ft}$$

and the weight and diameter of covered conductor are 0·244 lb/ft and 0·437 in. respectively. With a wind pressure at 16 lb/sq ft (B.S. 1320 loading) the wind loading is given by $0{\cdot}437\times 16/12=0{\cdot}582$ lb/ft.

The resultant maximum loading is $\sqrt{\cdot 582^2+\cdot 244^2}=0{\cdot}631$ lb/ft and under this load the tension at 22° F is 1,170 lb.

The equation relating tension and loading for a given span, in the case of individual spans between rigid supports; or for a given equivalent span, in the case of a section of line on flexible supports, with rigid supports at each end of the section, is

$$T_2^2(T_2+AL^2-T_1+Kt)=BL^2,$$

for lines having spans short enough to justify the use of parabolic equations. This is the case for all wood pole lines, and for the majority of steel tower lines erected in this country.

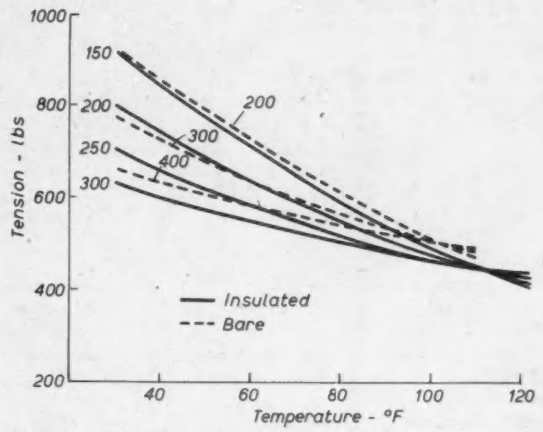


Fig. 1. Tension/Temperature curves for 0·05 sq in. h.d. copper—based on B.S.1320 loading

In the above equation

$$A=\frac{Ea}{24}\cdot\frac{w_1^2}{T_1^2} \qquad B=\frac{Ea}{24}\cdot w_2^2$$

TABLE I. 0·05 sq in. H.D. Copper Conductors (Insulation 60 mils P.V.C.)
Basic Conditions as B.S.1320

Temperature °F	Tension (lb) in still air for stated conductor and equivalent span							
	Bare 250′	Insulated 175′	Bare 300′	Insulated 205′	Bare 350′	Insulated 235′	Bare 400′	Insulated 260′
30°	846	860	774	793	711	730	664	685
40°	786	792	725	730	673	682	635	645
50°	728	730	678	680	637	637	608	607
60°	675	670	636	631	605	597	583	575
70°	626	616	598	585	576	560	560	544
80°	583	568	564	545	549	528	539	517
122°	442	410	454	418	461	424	468	428

$K = \alpha Ea$ L = Span (or equivalent span) in feet

where E=Young's Modulus (18×10^6 for h.d. copper)

α=coefficient of linear expansion $9{\cdot}222 \times 10^{-6}$/°F.

a=conductor area in sq inches

T=conductor tension in lb

w=weight per ft of conductor in lb (including any superimposed load)

t=temperature difference between initial and final state, and is positive for a rise in temperature.

The suffixes 1 and 2 refer to the initial and final states, i.e. in this instance w_1=0·631 lb/ft and T_1=1,170 lb at 22° F, while w_2 and T_2 are the corresponding values in still air under erection conditions, so that w_2=0·244 lb/ft. From the data already given it will be found that the coefficient A=·01096, B=2240 and K=8·3, and the equation becomes

$$T_2^2 (T_2 + 0{\cdot}01096L^2 - 1170 + 8{\cdot}3t) = 2240L^2$$

Erection Temperature	30°	40°	50°	60°	70°	80°	122°
Corresponding t	8	18	28	38	48	58	100
8.3 t	66	150	232	316	398	481	830

For a 150 ft span L^2=22,500 and at 30° F

$$T_2^2 (T_2 + 246 - 1170 + 66) = 5{\cdot}045 \times 10^7$$

Therefore T_2=918 lb.

In this manner tensions can be calculated for a range of spans for various temperatures, and curves of tension against temperature may be plotted. Such curves for 150 ft, 200 ft, 250 ft, and 300 ft spans are shown on the chart Fig. 1 (full lines for insulated conductor). On the same chart curves for bare conductor have been plotted for 200 ft, 300 ft and 400 ft spans (dotted lines) using figures taken from Table II (D) and (A) in B.S. 1320. It can be seen that the two sets of curves cross one another at an acute angle, but are displaced vertically. At approximately 60° F the 200 ft curve for insulated conductor crosses the 300 ft curve for bare conductor.

It thus appears that, for this size of conductor, the tensions in an insulated span will not differ greatly from those in a bare span, over a fairly wide range of temperatures, if both conductors are to have the same tension under the worst loading conditions specified, provided that the two span lengths are suitably chosen. In Fig. 2 curves of tension against span length at various temperaturrs for the 0·05 sq in. insulated conductor are shown. These have been plotted from the values calculated as indicated above. From these curves, and from figures taken from Table II of B.S. 1320, Table I was prepared. In this table the span for the covered conductors was determined from Fig. 2 on the basis that the tension at 50° F should be practically the same as that for the corresponding span of bare conductor at the same temperature. It will be seen that in all cases the tension difference between the bare and the covered conductor in corresponding spans does not exceed about 20 lb over the range 30° to 80° F. This range is likely to cover all erection conditions encountered in this country.

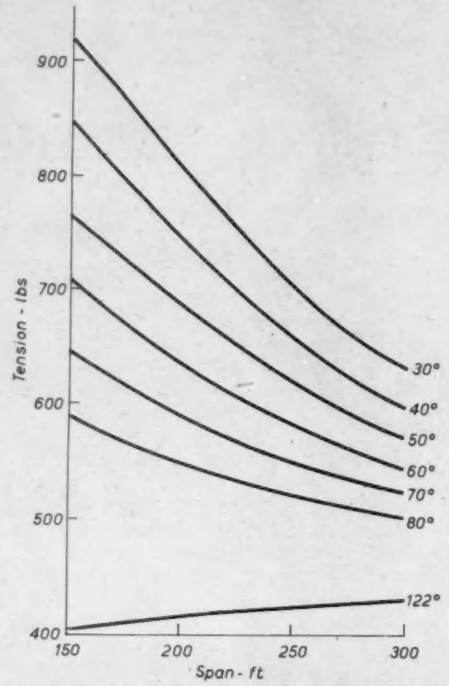


Fig. 2. Tension/span curves for 60 mil p.v.c. insulated 0.05 sq in. h.d. copper—based on B.S.1320 loading

Other Sizes of Conductors

Figs. 3, 4 and 5 show tension/span curves for 0·025 sq in., 0·1 sq in. and 0·15 sq in. h.d. conductors insulated with 60 mil p.v.c.; the 0·025 sq in. conductor being erected so as to have maximum tension and loading in accordance with B.S. 1320 Clause 3 a, and the other two conductors being erected in accordance with Clause 15 of El.C.53, 1947 Revise; except that for the 0·15 sq in. conductor the maximum design tension is 4,000 lb in order to maintain a 2½ factor of safety with 10,000 lb strain insulator sets.

Tables II, III and IV show corresponding span length for bare and insulated conductors of these three sizes. These were prepared in the same way as Table I, except that in preparing Table IV the tensions for insulated conductor were those calculated for the span lengths given while the spans and tensions for bare conductors were taken from a suitable chart. From these three tables it is apparent that for those conductors also, insulated and bare spans may be so chosen that, if their maximum design tension

TABLE II. 0·025 sq in. H.D. Copper Conductors (Insulation 60 mil P.V.C.) Basic Conditions as B.S.1320

Temp. °F	Tension (lb) in still air for stated conductor and equivalent span									
	Bare 200′	Insulated 128′	Bare 250′	Insulated 157′	Bare 275′	Insulated 170′	Bare 300′	Insulated 181′	Bare 350′	Insulated 203′
30°	412	415	350	354	323	330	301	312	269	278
40°	378	380	324	325	301	304	284	288	257	261
50°	346	346	300	300	281	281	267	267	246	246
60°	316	316	279	276	264	260	253	250	237	232
70°	290	286	260	254	248	242	241	234	228	220
80°	265	263	243	235	234	225	229	218	220	208
122°	189	178	190	177	190	176	191	176	192	175

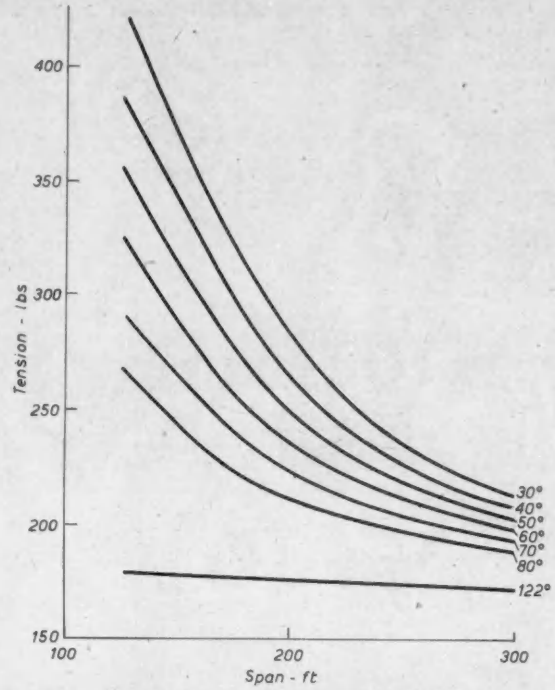


Fig. 3. Tension/span curves for 60 mil p.v.c. insulated 0.025 sq in. h.d. copper—based on B.S.1320 loading

is to be the same, their erection tensions will also be approximately equal.

In order to assess the practical significance of the errors which this approximate treatment may introduce, let us first consider the corresponding sags. The sag of a conductor is given by $S=wL^2/8T$. Thus for a 260 ft insulated span of 0·05 sq in. insulated conductor the sag at 30° should be 3·01 ft.

If the conductor is sagged with a section of bare conductor, having the corresponding equivalent span of 400 ft at 30° F, it will have a tension of 664 lb, and consequently a sag of 3·11 ft. The error in this case is only 0·1 ft and it is unlikely that this degree of accuracy would be achieved by the normal methods of sagging employed on wood pole lines. If, on the other hand, the conductors were erected at a temperature of 80° F, the corresponding sags are 3·99 ft and 3·82 ft. In this case the insulated span will be slightly over-tensioned when erected with the bare section. The sag difference of 0·17 ft (i.e. 2 in.) is still slight, and again it is doubtful whether any greater degree of accuracy will be obtained by normal methods of sagging. Again, if we consider Fig. 2 it can be seen that for the 260 ft span a temperature difference of 10° F corresponds to a tension difference of about 30 lb, so that the 20 lb tension difference corresponds to a temperature difference of about 7° F. For the 175 ft span the 15 lb tension difference (Table I) corresponds to only about 3° F temperature difference. In practice it is always difficult to obtain a satisfactory measurement of the conductor temperature and it is very questionable whether results can be relied upon to within 3° F.

Finally it can be calculated that, if a 175 ft span of insulated 0·05 sq in. copper were tensioned to 583 lb at 80° F, the tension at 22° F loaded with 16 lb/sq ft wind pressure would be 1,187 lb, i.e. about 1·5% error, while if a 260 ft span were tensioned at 539 lb the corresponding

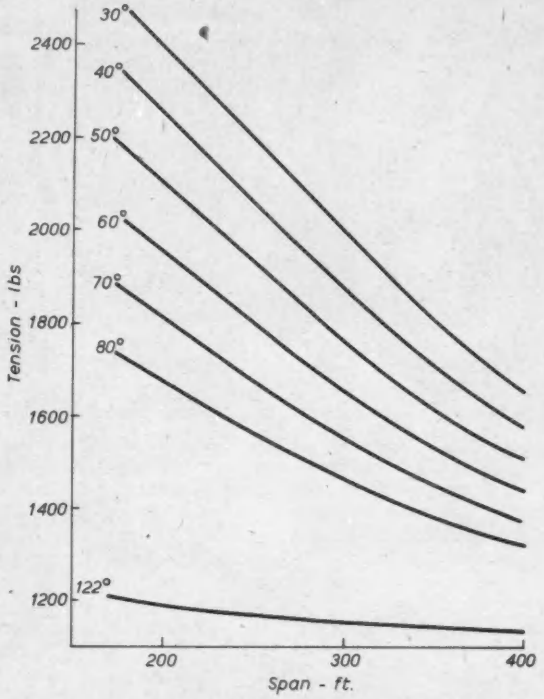


Fig. 4. Tension/span curves for 60 mil p.v.c. insulated 0.1 sq in. h.d. copper (7/·136 in.)—Based on El.C. 53, Clause 15, loading and 2936 lb tension

22° F loaded tension would be 1,203 lb; less than 3% over tension.

From Table II it can be seen that in the case of the 0·025 sq in. conductor the maximum tension difference for the range of spans considered and the probable erection temperature, is twelve pounds. The resulting maximum error in erection sag on the 203 ft span would be about 2 in. The tension error at 22° F under loaded conditions would be about 2½%. From Table III the greatest tension difference likely to occur with the 0·1 sq in. conductor is 30 lb, on the 200 ft span. This corresponds to a 2° F temperature error (see Fig. 4). The error in sag is negli-

TABLE III. 0·1 sq in. (7/·136 in.) H.D. Copper Conductors (Insulation 60 mils P.V.C.). Basic Conditions: Tmax=2,936 lb with wind and ice at 22° F as Clause 15 El.C.53

Temp. °F	Tension (lb) in still air for stated conductor and equivalent span									
	Bare 200′	Insulated 187′	Bare 250′	Insulated 228′	Bare 300′	Insulated 272′	Bare 350′	Insulated 319′	Bare 400′	Insulated 365′
30°	2,500	2,445	2,300	2,280	2,130	2,100	1,940	1,920	1,750	1,750
40°	2,320	2,300	2,150	2,140	1,985	1,970	1,820	1,805	1,660	1,660
50°	2,145	2,145	2,000	2,000	1,850	1,850	1,700	1,700	1,575	1,575
60°	1,995	1,995	1,860	1,862	1,730	1,730	1,600	1,602	1,500	1,500
70°	1,850	1,845	1,725	1,730	1,605	1,610	1,505	1,510	1,420	1,420
80°	1,705	1,705	1,605	1,610	1,505	1,510	1,420	1,430	1,350	1,360
122°	1,180	1,200	1,170	1,180	1,150	1,162	1,133	1,150	1,125	1,140

TABLE IV. 0·15 sq in. (7/·166 in.) H.D. Copper Conductors (Insulation 60 mils P.V.C.). Basic Conditions: Tmax=4,000 lb with wind and ice at 22° F as Clause 15 El.C.53

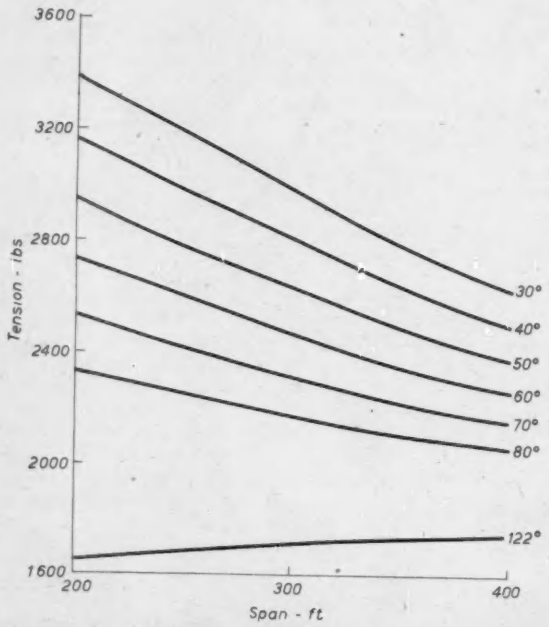
Temperature °F	Tension (lb) in still air for stated conductor and equivalent span							
	Bare 214′	Insulated 200′	Bare 328′	Insulated 300′	Bare 385′	Insulated 350′	Bare 440′	Insulated 400′
30°	3,400	3,389	2,990	2,986	2,780	2,785	2,600	2,610
40°	3,170	3,165	2,810	2,802	2,630	2,630	2,488	2,487
50°	2,945	2,947	2,632	2,632	2,485	2,485	2,370	2,366
60°	2,736	2,734	2,460	2,469	2,350	2,350	2,260	2,257
70°	2,530	2,530	2,310	2,318	2,220	2,227	2,156	2,155
80°	2,330	2,334	2,160	2,176	2,100	2,110	2,060	2,060
122°	1,630	1,649	1,700	1,708	1,723	1,728	1,740	1,745

gible, and the corresponding tension error at 22° F (loaded) is less than 1%. From Table IV it is obvious that the errors introduced for the 0·15 sq in. conductor are negligible.

Effect of Varying Insulated Span

It is interesting to note from the tables the effect of varying the length of insulated span in any section having a given equivalent span. Thus, if for the 0·05 sq in. conductor (Table I) in a section having an equivalent span of 350 ft an insulated span of 260 ft were introduced this span would (in theory) be erected at a tension ranging from 711 to 549 lb, according to the erection temperature, instead of one ranging from 685 to 517 lb and the tension would be 26 to 32 lb too high. On the other hand if the insulated span were only 205 ft the erection tension would vary between 711 and 549 instead of between 793 and 545.

Fig. 5. Tension/span curves for 60 mil p.v.c. insulated 0·15 sq in. h.d. copper (7/·166 in.)—Based on El. C.53, Clause 15, loading and 4000 lb. tension



In this case the tension would generally be too low, and the error on the side of safety. Accordingly the span lengths for insulated conductor given in the tables should be regarded as maxima in sections of the corresponding equivalent span shown for bare conductor, and in general a lower figure—perhaps 90% of that shown in the table—should be chosen.

In order to use Table I to IV find the equivalent span of the section in which the crossing span occurs. It may not be possible in the design stage to find this accurately, but as it is by no means critical it is suggested that the average span will in most cases serve at least for a first approximation. From the appropriate table (column heads)—interpolating as necessary—find the insulated span which will correspond to this equivalent base span. This is the maximum length of crossing span which should be employed in this section.

Conclusion

From the above it will be seen that the necessary condition regarding the factor of safety of conductors can be met by a proper choice of crossing span. Ordinary intermediate poles can thus be used at the crossing, mid-span joints being inserted in the adjacent spans either side of the crossing.

It should, of course, be noted that while (as can be seen from the tables) the tension differences at 122° F between bare and insulated conductors are slight, the effect of the weight of insulation will be to increase the sag of the latter. Consequently the sag curve used for the bare conductor will not prove a reliable guide to clearances in the insulated span. Either a special sag curve should be used or an adequate allowance made.

CHURCH HEATING

HEATING a church can be a problem difficult of solution, and to assist clergy and churchwardens to tackle it, the Central Council for the Care of Churches has prepared a brief pamphlet based on a full technical report which is promised for the near future. In the pamphlet it is stated that ". . . there emerges, in spite of a considerable divergence of opinion, a general agreement that electricity, while offering great possibilities for church heating, is suitable only in certain circumstances." However, this somewhat equivocal judgment does not prevent discussion of three types of electric heating: tubular heaters, electric convectors and unit heaters.

Electric heating, it is suggested, is more suitable for personal comfort heating than for warming the structure of the church itself. Emphasis is placed on the virtue of the rapid response to control offered by electric heating, and it is suggested that it is not suitable for systems which do not make the maximum use of the flexibility of this source of heat. It is also flatly stated that electricity should not be considered for churches which require continuous heating. A reasonable electricity tariff, for heating purposes, is considered to be one not exceeding 1d. per unit. In notes on installation, it is emphasised that an adequate loading must be provided. An electrical heating system which is too small will not only be unsatisfactory in performance; it will also be more expensive in energy consumption. Time switches are recommended for the automatic operation of electric heating systems, but it is considered exceptional for thermostatic control to be worth while.

The pamphlet "Church Heating" is published, price 1s., by the Church Information Board, Church House, S.W.1.

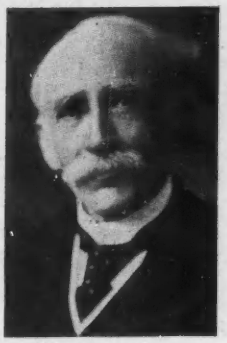
The Jubilee of the Thermionic Valve

An electronics expert adjusts a valve screen on a section of the pilot model of the N.P.L. Automatic Computing Engine at Teddington

CELEBRATIONS TO MARK THE WORK OF SIR AMBROSE FLEMING

ON 16th November, 1904, a patent was taken out which has proved to be the basis of one of the greatest scientific developments in modern times. This patent was for the thermionic valve, known for some years as the Fleming valve.

In honour of the fiftieth anniversary of the valve, several special arrangements have been made. At the Institution of Electrical Engineers, the whole of Tuesday afternoon was devoted to a "Celebration of the Jubilee of the Thermionic Valve." An opening address was given at 2.30 p.m. by the Most Hon. the Marquess of Salisbury, K.G., P.C., Lord President of the Council, followed by a lecture on "The Genesis of the Thermionic Valve" by Prof G. W. O. Howe. After this Sir Edward Appleton gave a lecture on "Thermionic Devices from the Development of the Triode up to 1939," and finally in the evening Prof J. Thomson dealt with "Developments in Thermionic Devices since 1939."



Sir Ambrose Fleming

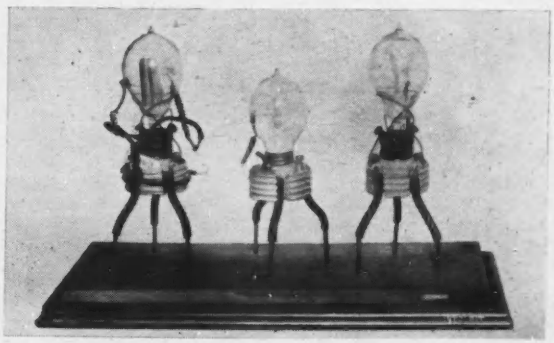
At University College, an exhibition is being held in the Electrical Engineering Laboratories which on Tuesday was open from 11.30 a.m. to 2 p.m., on Wednesday from 3 p.m. to 10 p.m., and today (Thursday) from 6 p.m. to 9 p.m. Today's opening is restricted to members of the Television Society and their guests.

Sir Ambrose Fleming

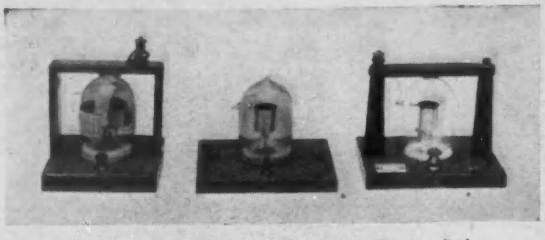
Sir Ambrose Fleming was born near Lancaster on 29th November, 1849, and was educated at University College School, then located in Gower St. He worked for his science degree by private evening study at University College, and a contemporary of his was Alexander Graham Bell, who emigrated to Canada early in life for reasons of health. Fleming, after a period at Cambridge, returned to University College in 1884 at the invitation of Carey Foster to give a course of lectures on electrical technology, and in the following year became Professor of that subject, a post he held with great distinction for some forty-one years.

In 1901 Marconi was planning to set up a radio station at Poldhu in Cornwall with the object of attempting to send wireless messages across the Atlantic. Much of the technical work in connection with the project was carried out by Fleming in the Electrical Engineering Department of the College. The invention of the thermionic valve is described in Fleming's own book "Fifty Years of Electricity." We quote the relevant chapter below.

"The author had carefully studied in 1883 and 1896 as already mentioned in Chapter III, the so-called "Edison Effect" in glow lamps, discovered by Edison in 1883, and by 1904, as a consequence of the researches of Sir J. J. Thomson, it was well known that an incandescent filament of carbon in a high vacuum was giving off torrents of electrons or particles of negative electricity. Also it had been found by the author that the space in a high vacuum between an incandescent cathode and a cold anode could conduct negative electricity from the hot to the cold electrode, but not in the reverse direction. It was not at all obvious, however, that a carbon filament incandescent lamp with a plate sealed into the bulb could be used to rectify high-frequency alternating currents that is, to convert them into continuous or direct currents. Mr Edison had made no such use of his "Edison Effect" lamps, nor had it occurred to anyone, until the author pointed it out, that such a lamp, having a metal cylinder



Three of Fleming's original "Oscillation Valves"



Early Marconi production models of the Fleming diode

surrounding the filament and carried on a wire sealed through the bulb, could be used to rectify high frequency currents, and, therefore, as a detector of electric waves in wireless telegraphy.

The author, however, constructed in 1904 some carbon filament incandescent lamps in which the filament was surrounded by a metal cylinder carried on a platinum wire sealed through the bulb. These lamps had their filaments made incandescent by a six cell storage battery and were connected with the receiving circuit of a wireless telegraph apparatus."

Subsequently in January 1907, the grid was introduced into the valve by Dr Lee de Forest. It is, however, noteworthy that the use of tungsten as a valve filament was suggested by Fleming in a British Patent Specification No. 13,518 of 1908.

The Marconi Company adopted Fleming's invention at once and in a short while the "Fleming Oscillation Valve" was in production. When de Forest patented the triode, it was at once challenged in U.S.A. by Marconi, and after several important legal actions it was established that the principle involved in the Fleming valve was fundamental, that it had priority and that the grid was merely an improvement on the basic idea.

At this period, progress in wireless telephony was awaiting a practical, reliable and reasonably cheap method of generating a constant and easily controlled train of high frequency oscillations which could be modulated at sound frequencies. Various methods were being tried, among them arc and direct generation by high frequency alternator. These met with qualified success, but fell short on grounds of economy and reliability, for commercial adoption on a large scale. The triode valve had been in existence for nearly five years, before, with remarkable coincidence Meissner in Germany, Franklin and Round in England and Armstrong in America all discovered in 1913 that by coupling the grid and plate circuits of a triode valve it could be made to generate continuous high frequency oscillations which were steady, pure in form and could be easily modulated.

In the techniques of valve development, the most active early work was pursued in the U.S.A. The outbreak of war, however, stimulated manufacturers in this country to rapid improvement. Although the oxide coated cathode had been produced by Wehnelt in 1904, it was about twenty years before it became generally accepted and the "bright-emitter" types gave way to the "dull-emitters." As more became known, the number of grids was increased. Among early examples which most radio enthusiasts will recall to mind were the "screened grids." Indirectly heated cathodes, combined valves, gas-filled valves for high current rectification and numerous varieties designed for special duties have since been made.

At the University College Exhibition, which is devoted mainly to the work of Fleming, both as an inventor and as a teacher, some examples are shown of modern valves including those designed for ultra-high-frequency work. There are also demonstrations of radar techniques, and of the research work being carried out in the electronics and telecommunications laboratories in the College.

Transmission at Standard Frequencies

A TRIO of papers presented last week to the I.E.E. Radio Section provided a clear overall picture of a service now provided by the National Physical Laboratory, whose importance is often only occasionally recognised by those outside its immediate concern. The reference here is to radio transmissions at standard frequencies of 60 kc/s and 2·5, 5 and 10 Mc/s which provide means of accurately checking local standards of time. Such transmissions require the higher possible accuracy, of the order, at present, of about ± 2 parts in 10^9, which enable time scales of radar displays, the echoes in geological prospecting, and the control of television transmission at the same frequency from different stations, to be accurately timed.

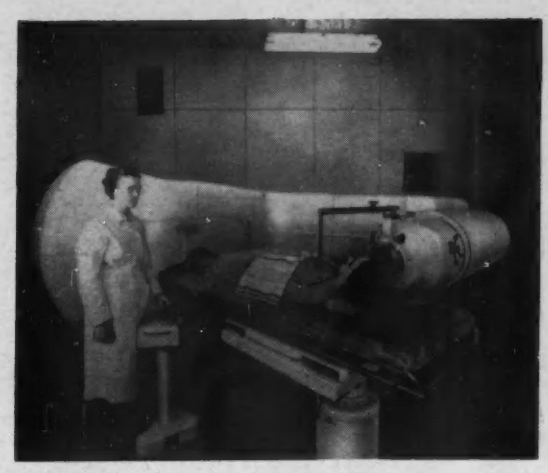
The three papers presented an up-to-date survey of the subject, ranging from a consideration of standard frequency transmission (by L. Essen) through a description of the N.P.L. Service (by H. B. Law) to a discussion of the monitor (by J. McA. Steele) by which transmissions are received and checked for accuracy. After a brief historical survey the opening paper discussed the N.P.L. Service (recognised by its call sign MSF) which, as mentioned previously, is provided at four frequencies. The 60 kc/s transmission is well received throughout the United Kingdom and Western Europe, and as its ground wave only is received, is consequently free of Doppler effect. From the point of view of accuracy this freedom is particularly advantageous, and the transmission is widely used as a primary time standard in a large number of Government, industrial and university research establishments.

At higher frequencies, transmissions were initially provided only for short periods during the day in order to determine the type of service which should be provided. Information from users indicated that, for continuous operation, attention should be devoted to the European area, and the present programme gives a satisfactory 24 hour service over a radius of about 1,000 miles.

Accuracy of the 60 kc/s transmission is high, the frequency varying between 2 and 6 parts in 10^9 per month. This has been corrected by step adjustments to maintain it at approximately 2 parts in 10^8. The aim has been to maintain the frequency to within one part in 10^8 of the nominal value as measured by the unit of time in current use, and at the same time to make as few adjustments as possible so that users may rely on day-to-day stability of ± 2 parts in 10^9.

At the higher frequencies, the received frequencies are within ± 2 parts in 10^8 of the value at the transmitter. This accuracy is obtained, for the 2·5 Mc/s transmission, during some of the daylight hours of the summer months but at other times, the accuracy may fall to several parts in 10^7. In general, the 5 Mc/s transmission is received as well in the United Kingdom but, in contrast, it is somewhat less stable in daylight hours and more so at other times. A 1 c/s timing pulse modulates the standard transmissions at the higher frequencies. As this can be received in this country with an accuracy of 0·1 millisecs or better, it provides a comparison accurate to within ± 2 parts in 10^9 in 24 hours.

New Equipment for Radiotherapy



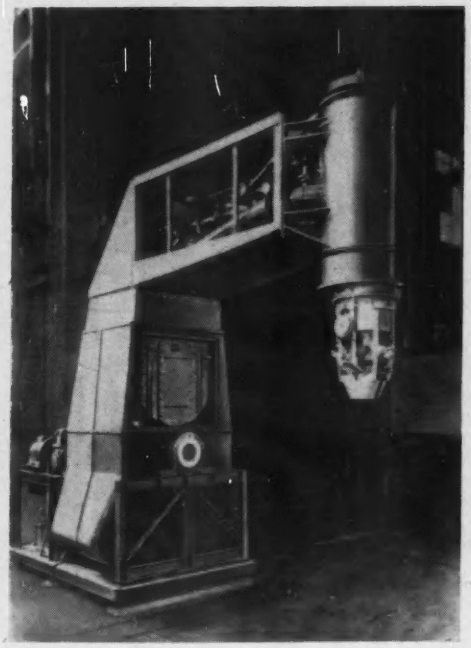
MEDICAL RESEARCH COUNCIL HAVE IMPRESSIVE RANGE OF MACHINES AT CHRISTIE HOSPITAL

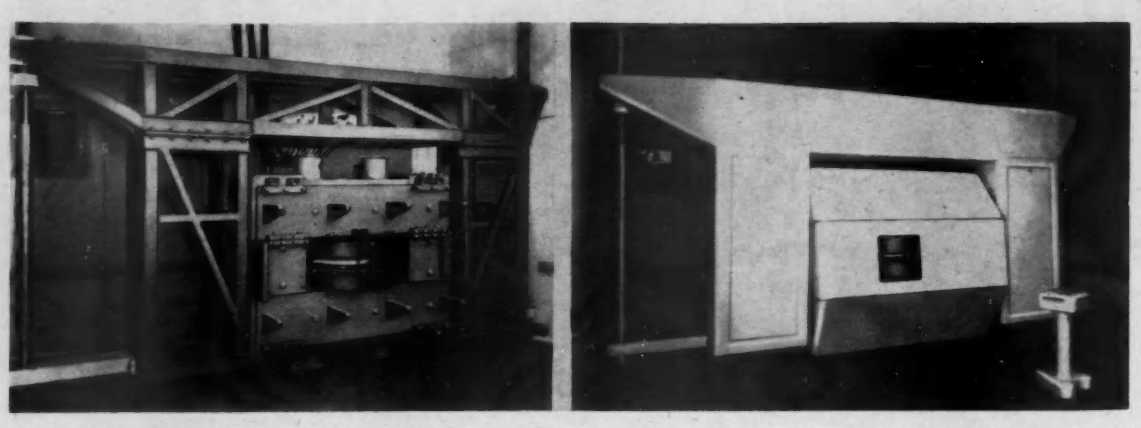
CONSIDERABLE attention of late has been given to the use of high electron energies, of the order of magnitude normally associated with nuclear physics in the X-ray treatment of cancer, to augment that given by conventional machines. The travelling wave linear electron accelerator, a wholly British development, has figured largely in this upwards trend, and two notable examples of its use for medical purposes (an 8 MeV machine at Hammersmith and a 15 MeV machine at St. Bartholomew's hospitals) have recently been described. Apart from these machines, five others, all of 4 MeV, are being commissioned, under the auspices of the National Health Services, for use at centres to provide a coverage over the whole country specifically for treatment.

One of these smaller machines has now been installed at the Christie Hospital and Holt Radium Institute, Manchester, in a new building provided by the Medical Research Council. This installation, however, is unique by virtue of its high energy electron generator—a 20 MeV betatron, which is the only clinical adaption of this machine in the country. Together with a conventional type of X-ray machine, producing 300 KeV, the building provides facilities for radiotherapy unparalleled in this country and possibly in the world.

From the clinical viewpoint, higher voltage X-rays offer several advantages. Not only is the skin absorption problem reduced (the maximum dose is produced some distance below it) but the bone absorption is also less, whilst the higher frequency of the radiation has greater penetration and enables a more sharply defined beam to be produced. At the same time the increased dose rate permits shorter treatment times. In operation, the 4 MeV linear accelerator, manufactured by the Metropolitan-Vickers Electrical Co., Ltd., under the trade name of "Orthotron," is unlikely to present many difficulties and should be in use for routine treatment quite soon. On the other hand, the betatron, with its much higher electron energy of 20 MeV, will not be used for serious treatment until a considerable amount of experimental work with it has provided the necessary experience of operating at this level. The betatron, also a Metrovick machine, is a gift to the hospital by the company as a gesture of co-operation in exploring the use of super-voltage machines for clinical purposes. A subsidiary, Newton Victor Ltd., supplied the 300 keV machine.

In our heading illustration, the Metrovick 4 MeV Orthotron is shown ready to provide a horizontal X-ray beam. Below are two views, the machine in its vertical position, and during construction at the works





The Metrovick 20 MeV betatron at Christie Hospital, left under construction, showing the two coils, and "doughnut", and right, in its final appearance

Betatron Operation

Unlike the "Orthotron," in which the electrons are accelerated by a travelling radio wave, the betatron employs a magnetic field as the accelerating medium. The main feature of the machine is thus its large a.c. magnet, having specially shaped pole pieces between which a continuously evacuated glass toroid or "doughnut" is inserted. An electron gun, mounted radially in the outer surface of the doughnut, emits a 4 microsecond pulse of 60 keV electrons tangentially at the point at which the magnetic field is just increasing from its zero value, thus sending a stream travelling in a circular orbit. As the magnetic field increases, the energy of the electrons rises by magnetic induction, and, gaining some 80 eV in each revolution, electrons eventually attain some 20 MeV after travelling nearly 300 miles. At this stage the orbit is expanded, causing the electrons to hit a small platinum target mounted at the end of the gun, thus producing a narrow cone of X-rays in the forward direction.

The betatron magnet is excited at 150 c/s from a tripling transformer whose primary is energised at mains frequency, so that an open star secondary supplies only the third harmonic. To minimise power consumption, the magnet winding is made to resonate with a 1,600 kVA capacitor bank, which makes it only necessary to supply the losses, amounting to some 20 kW. In the final machine, the magnet is mounted on a central structure which is supported at each end by lead screws, enabling the entire framework to be raised or lowered through 7 ft. It may also be rotated through 120° from 15° above the horizontal to 15° beyond the vertical, to enable the X-ray beam to be projected in any direction.

The "Orthotron" linear accelerator employs a single accelerating waveguide, which being only 1 m in length, has made possible the use of an adjustable mounting which may be swung to any angle required for treatment. The waveguide is mounted at the end of an overhung beam 6 ft long, supported on a radial structure which may be rotated through a 135° arc. The axis of rotation coincides with the treatment point which is fixed for convenience at 100 cm from the electron target. The magnetron and other associated equipment for the accelerating waveguide is housed in the panelling covering the overhanging beam.

In operation, the magnetron is pulsed at up to 500 pulses/sec, providing some 2 MW peak radio frequency power at 10 cm wavelength in the 2 microsecond pulse. The wave enters the input end of the corrugated waveguide at approximately 40% of the speed of light and accelerates to 0·996 of that speed. The pulsed electrons, entering at the same speed, are accelerated with the wave, and by the time they reach the target have increased their mass by approximately 8·6 times. Attention has been paid to the rapid replacement of components by providing a waveguide window which enables the magnetron to be removed without disturbing the vacuum inside the remaining waveguide system, whilst the electron gun has a four filament turret to enable filaments to be changed in only a few minutes.

The other machine in use in the annexe, a "Resomax 300" conventional X-ray generator, employs a resonant type h.v. transformer which enables the special multi-sectioned X-ray tube to be mounted coaxially inside it. The tube target, which is at earth potential, projects some 30 in. from the main oil tank in which the transformer and h.v. cathode ray gun end is immersed. As the X-ray tube head is mounted on a single pillar type stand, an unobstructed floor area is obtained for manoeuvring the treatment table.

Research into non-clinical uses

Following the visit to the hospital, Metropolitan-Vickers made arrangements for a tour of their research laboratories at Trafford Park, where not only are further orthotrons under construction, but laboratory machines are being used to explore other applications of electron or X-ray irradiation. One important industrial use being thus explored is the radiography of heavy and thick objects, such as steel castings, for flaws, and in this connection both types of machine have excited considerable application.

The orthotron, however, has the distinct advantage of making its electron beam readily available, enabling it to be used for electron irradiation. One application being studied is the sterilisation of pharmaceutical products in their final packaged forms whilst another avenue being explored is that of plastics bombardment. In this use, the irradiation of polythene produces a material which, in contrast to the normal state, remains substantially unaffected by temperatures well above 100°C.

Several other materials—nylon, polystyrene, polychloroprene, and natural rubber—behave similarly to polythene, and the main effect of increased heat resistance coupled with decreased solubility has been attributed to cross-linking. Other materials, including poly-isobutylene, butyl rubber, p.t.f.e., and methyl methacrylate behave differently, degradation taking place. In the case of the latter, it has been suggested that the degradation may be turned to good account. Irradiation of the material liberates gases which, normally, are retained in the material under considerable pressure. If, however, the methyl methacrylate is then heated to its softening point, a foamed material, eight times the original volume, is formed, having low effective dielectric constant, high resistance and low density.

notes on wiring

by Megohm

I RECENTLY read the précis issued by H.M. Senior Electrical Inspector of Factories on the subject of electrical fatal accidents in the home. This was reported in the ELECTRICAL TIMES on 21st October, 1954, and has since been the subject of letters in "Readers' Views". The précis does not make pleasant reading, and I took the liberty of handing it to a fellow traveller one day and asked him to read it. He looked decidedly paler when he had finished, but he did make an extremely sensible suggestion. He suggested that the précis be published in the national newspapers *in its original form.* I agreed with this but, of course, every other report on fatal accidents would require to be published. However, I consider that the report should be published in the architectural press and circulated amongst the town and county councils.

Electric Irons

Nine deaths resulted from faults occurring in electric irons, their connectors or flexibles. Most of the irons had, apparently, been of the type which employs the removable connector and it would appear that this was the main cause of the accident in five cases. I prefer the type of iron which incorporates the connections in the body and thus eliminates the danger of the connections being easily damaged or tampered with. In one instance, it is stated that a woman, the mother of three children, was accustomed to doing her ironing in the kitchen, *although she had to heat the iron from a power point in the dining room.* When the iron was hot, she detached it from the connector on the flexible cord which was left lying on the floor. The connector had been broken and the two brass contacts were exposed. One of her children aged nearly two, who had been playing on the floor, was found dead with one contact in her mouth while holding the other in her hand.

Apart from the matter of the broken connector there remains the fact that the iron had to be heated in another room—obviously some bad planning in the electrical installation. I agree that not every kitchen is suitable for ironing, but surely this important room should be equipped with at least one socket. How many other homes are so badly planned? All too frequently the electrical installation is merely a "Provisional Sum" in the architect's bills of quantities or specification. The sum shown against this item is often the result of a wild guess and the contractor, who is subsequently engaged to do the work, is faced with the problem of planning an installation to suit the stated price and not the cost to suit the stated requirements. Housing authorities are often guilty of cutting down the electrical installations in new houses to a bare minimum—or should I say "dangerous" minimum? There is absolutely no excuse for this apparent ignorance because much has been written and said on the subject of adequate socket-outlets in the home. The introduction of the ring circuit for 13 amp sockets has assisted greatly on the economic side. There is also the matter of the many types of socket-outlets to be considered and it should be the duty of every contractor when employed on installations to advise on the best type of outlet to be used.

Dangerous Wiring

Electrical appliances are universally advertised these days. With the promise of "no more power cuts" we are also enticed to fill our homes with refrigerators, irons, etc., on "easy terms". In certain circumstances the invitation cannot be resisted. However, when the appliance arrives at the house, it is found that no suitable socket exists. It is then that, in many cases, the amateur wireman appears. Six fatal accidents due to faulty wiring were reported in 1953. It was obvious from reading about these fatalities that these unskilled alterations to electrical installations must be stopped. It is interesting to note that the person who does the "odd job" is seldom the victim.

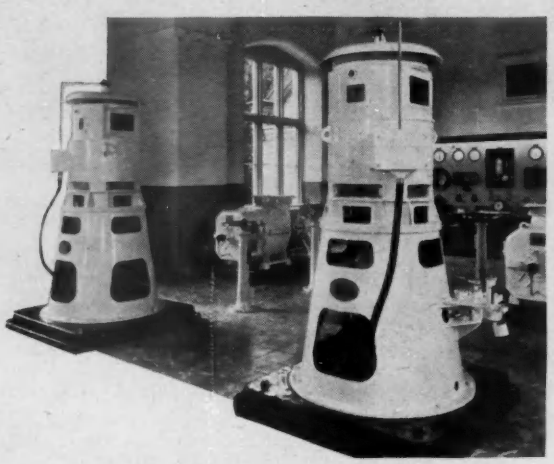
One of the most common places for the amateur to show his lack of knowledge is where a light is required in a hut or outbuilding not structurally connected to the main house. A length of cable, possibly purchased from a chain store, is usually slung between the house and the hut and taken into each building at some convenient place. The cable is pulled tight and in due course it becomes a source of danger. These outbuildings are very often used by the householder for some form of hobby. The electric drill is now being used extensively in home hobbies and it is therefore most important that, where such appliances are used, the wiring is in order.

One fatality which resulted from faulty wiring was due to someone having tapped the cables serving a socket in a room to provide another outlet. The man was found dead under the floor boards of a sitting room. Examination showed that, where the wiring to the first socket had been tapped, the joints had been taped with ordinary surgical tape and the lead sheath of the cables to the second socket was found to be "alive" due to the insulation on the "live" conductor being perished. The extension wiring was carried out in lead sheathed cable which was not properly bonded. It would appear that the deceased touched the lead sheath of the extension wiring and received an electric shock which proved fatal.

Another cause of accidents is wrong connection at socket-outlet positions. All too often the neutral is switched and this leads to shocks being received from faulty flexible cords when the switch is in the "off" position. The householder, quite rightly, imagines any appliance connected to a socket is "off" when the switch is so positioned. There is also the fact that switchboards are occasionally mounted upside down and this tends to give the user a false sense of security, as it is usually assumed that the dolly of a switch is pushed down to switch on. I have often considered that either a mechanical indicator should be incorporated in the switch-socket or the words "on" and "off" *clearly* shown. It is not enough in my experience to have these words engraved on the cover. They should be coloured in some contrasting colour to that of the switch-socket.

Electric Power for Pumping Water

Three Modern Water Supply Installations Recently Opened Utilise Electricity



Two electrically driven pumps installed at Fulbourne, Cambs.

TO many engineers, the gradual passing of the old reciprocating water pumping steam engines must arouse a feeling of regret. These huge beautifully kept machines are symbolic of a departing era in engineering. Electrically-driven pumps, however, have proved so reliable and economical, both in operating and building costs that they are now being installed in most new plants.

The Lasham Scheme

A new scheme was opened a few weeks ago at the Lasham pumping station of the Mid-Wessex Water Company. Until this latest development the underground workings consisted of a five-foot diameter well sunk to a depth of 100 ft below the surface with heading some ten ft above the base of the well extending roughly north and south for a total distance of 360 ft. The pumping well was equipped with two sets of electrically driven centrifugal pumps which have an output of 330,000 gallons per day, but it was found that in certain summers, following dry winters, the water availability fell to 150,000 gallons per day.

Latest work consisted of enlarging and deepening a 3 ft access shaft which now has a diameter of 6 ft, is 240 ft deep and has a test shaft of 21 in. bore extending to 260 ft. As a result a reliable yield of 2 million gallons per day has been established.

This shaft is now equipped with two temporary vertical-spindle centrifugal pumps driven by slip-ring motors at a speed of 970 r.p.m. each motor being rated at 60 b.h.p. When the well characteristics have been determined more accurately, two new sets of submersible pumping units will be installed.

For water distribution, six other pumping units are installed, comprising two English-Electric/Worthington-Simpson sets of 170 b.h.p.; two similar sets of 45 b.h.p. and two smaller 18 b.h.p. booster units also by the same manufacturers. It can thus be seen that a considerable loading is required.

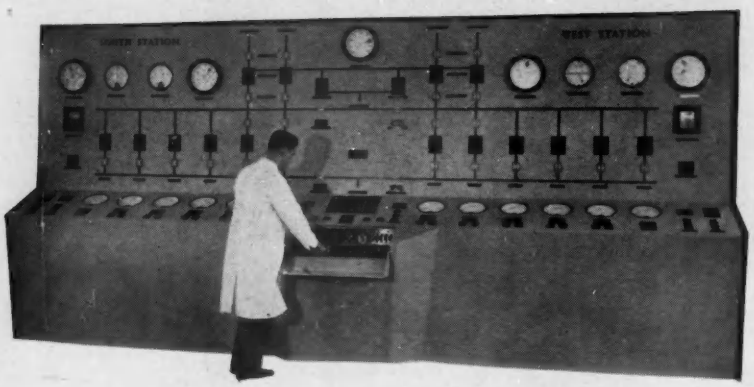
Supply is normally taken in from the Southern Electricity Board's 11 kV system, through a 500 kVA, 11 kV/415 V English Electric outdoor transformer. Emergency supply is available from an E.E. diesel alternator set type 8 SRK, rated to give a twenty-four hour continuous output of 464 kW. The incoming supplies, are controlled by an E.E. OB.3/CFS switchboard which comprises two OB.3 cubicles, one serving the main supply from the transformer and the other the supply from the alternator. Both are fitted with air circuit-breakers, together with the usual instruments including kWh meters with maximum demand indicators.

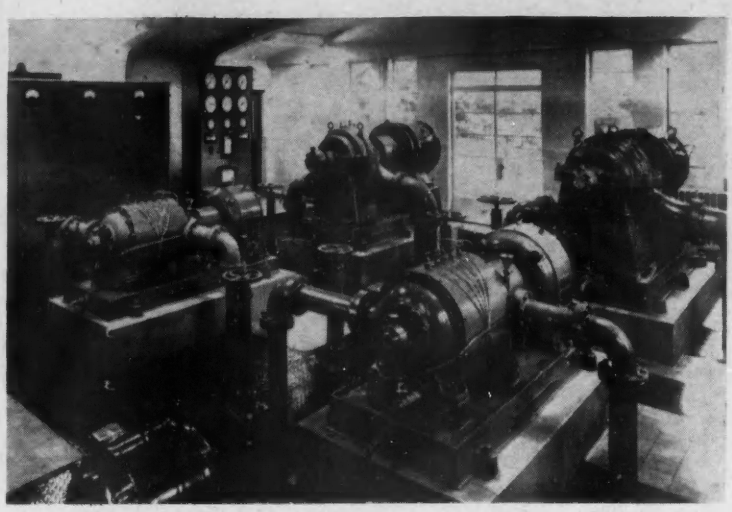
From the switchboard the power is distributed through a 900 amp t.p. and n. busbar chamber, to the control switchboard. The control equipment for the pump units is housed in an Allen West starter switchboard, of six panels. The two panels of the large units house the 170 h.p. auto-transformer starters and auxiliaries, for the medium size and small motors star-delta starters are used.

In the well-head pump house, the two English Electric/Harland units are hand started by type OSR.2.A totally enclosed, oil-immersed panels. Full protection is included, and two power factor correction condensers of 9 kVAr made by British Insulated Callender's Cables bring the well head system to 0·95 lagging. Other power factor correction condensers are also included in the surface pump house in connection with the four larger units.

Full water level and flow metering has been installed and is grouped in an "Electroflo" panel, and continuous readings of flows and pressures in the mains is provided by a three zone, six pen, strip chart recorder.

Eversbed and Vignoles control board at West Hull and Haltemprice





Main surface pumps at Lasham. These are all powered by E.E. motors and pump the well-head water to local reservoirs and to the mains

Main Drainage

Destined to be among the largest pumping stations in Europe is the West Hull and Haltemprice joint main drainage project. This large station pumps combined sewage and storm water from the low level sewers of Kingston-upon-Hull to the adjacent Humber Estuary. Four dry weather flow pumps of 3,000 cu ft/min. capacity and six storm water pumps of 9,000 cu ft/min. capacity, all electrically driven, are provided, together with two standby 1,000 h.p. deisel pumps, for operation during periods of maximum supply demand or power failure.

A main supervisory and control desk, and recorder cubicle together with associated equipment such as level and flow transmitters has been supplied by Evershed and Vignoles Ltd. The equipment provides automatic and manual pump control, indication and record of operation and also indicates fault and alarm conditions.

The automatic equipment is designed to operate so as to control the pumping rate in steps of 3,000 cu ft/min. between 0–18,000 cu ft/min. and to maintain the level in the suction sump within fixed limits throughout that range. Between 18,000 cu ft/min. and 63,000 cu ft/min. one or more pumps will be operated manually to provide base load pumping but over this base pumping load, the automatic control will still regulate the total pumping rate.

For selection purposes, plugs and sockets are provided so that any of the dry weather flow pumps or storm water pumps may be selected to operate under any of the six stages of automatic pumping.

Indicator lamps are provided to show which pumps are selected to operate under each particular stage, and also to show when a particular stage of pumping is required to operate. The actual operation of all pumps, both under automatic and manual control is indicated by other lamps. Indication and audible warning is given of fault conditions which may arise in any of the pumps, screening machines, penstocks or auxiliary equipment.

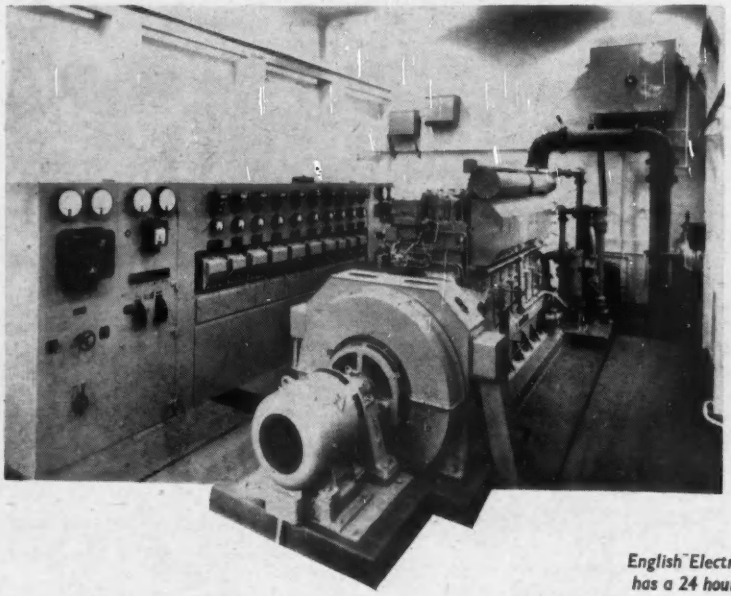
A special desk has also been supplied to initiate and indicate the operation of the oil circuit-breakers on the supply circuits and to give audible and visible alarm under fault conditions.

General mechanical and electrical design of the entire station was carried out by the City Engineer's Department of the City and County of Kingston-upon-Hull, working under the supervision of the Joint Engineers to the scheme, Mr William Morris, City Engineer and Mr R. B. Heseltine, Engineer and Surveyor to the Haltemprice Urban District Council.

Fulbourne

The third recently opened station is that at Fulbourne, Cambridge. This station was originally constructed in 1888 and equipped with Beam engine type pumps with an output of one million gallons per day. These were kept in operation until 1920 when the pumping station was closed down as being inefficient. During the war, the demand for water increased and the station was reopened for a period.

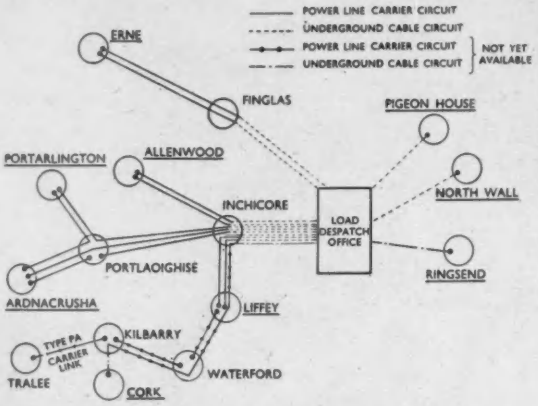
New electrically operated pumps have now been installed which can not only double the output, but also enable the rate of pumping to be varied from between one to two million gallons a day. All the plant, including the electrical equipment, has been duplicated even to the extent of installing a two-way feed from the grid so that chances of a breakdown affecting water supply are almost negligible.



English Electric standby diesel-plant installed at Lasham. This has a 24 hours continuous output of 464 kW for emergency use

Communication and Control over a Power System

POWER CARRIER COMMUNICATION IN IRELAND



THE Electricity Supply Board of Ireland is installing a comprehensive communication system operating largely over power-line carrier circuits. This system comprises supervisory indication, telephony and telegraphy, and covers the whole power network of the Republic of Ireland, bringing all its widely separated substations under the central control of the Load Despatch Office in Dublin. It is being provided by the General Electric Co. of England.

Many of the main 110 kV transmission lines radiate from Dublin and the G.E.C. power-line carrier equipment now in operation on some of these lines provides, in conjunction with certain cables, all the channels required for the services needed.

An automatic telephone system, entirely independent of the public telephone system, links two control engineers, associated divisional offices and generating and major switching stations. Any extension can dial any other—however distant—and the two control engineers have a master priority over any call. A conference facility enables either of them to issue simultaneous instructions to any six selected extensions. The supervisory indications present, on a wall diagram in the control room, information on the switching and loading conditions at each station, with continuous and selected metering facilities, and a teleprinter service provides a permanent record, where necessary, of the messages between the load despatch office and the generating stations.

Communication System

Both generating stations and major 110 kV transformer stations are linked by a series of underground cable and power-line carrier circuits to form the communication system shown in Fig. 1. Each communication circuit

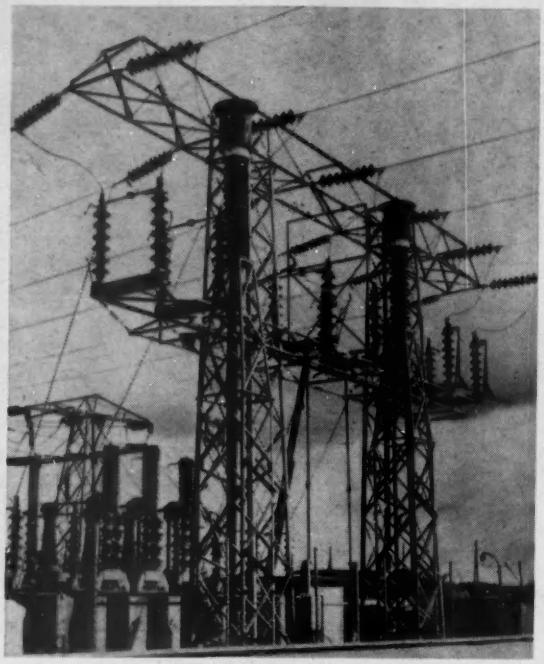


Fig. 1 left, is the layout of the communication system for the Irish power network, and above Fig. 2 is line coupling equipment at Port Laoighise substation. This equipment injects carrier frequencies into the power-line and isolates the communication equipment from power frequencies

provides facilities for a speech circuit, with its associated ringing channels, and independent superaudio duplex signalling channels suitable for supervisory or teleprinter operation. The communication network, together with its associated carrier and automatic equipment, is the property of the Electricity Supply Board and is controlled and maintained by the Board's staff.

Finglas, Inchicore, North Wall and Pigeon House stations are connected to the load dispatch office by sections of the underground cable network linking various stations and offices in the Dublin area. In certain cases the communication cables are run in close proximity to the 38 kV city distribution network, and gas discharge arrestors, fitted at the cable heads, safeguard the equipment from longitudinal induced voltages that may occur during fault conditions in the 38 kV network.

Operational Layout

Two main switching and transformer stations at Finglas and Inchicore have been chosen for the Dublin carrier terminal stations because of their connection to the main 110 kV overhead line routes and the availability of cables to the load dispatch office. In order to effect the maximum economy in cable and equipment, speech and signalling circuits to outlying carrier stations are combined at the office to form composite bands in the range 300-4,000 c/s, and these are connected to the carrier terminal stations by four-wire cable circuits. These circuits, and those carried by the telephone circuits to Inchicore and Finglas, are equalised and amplified at the "receive" end of each channel to compensate for the cable frequency/loss characteristic.

The system affords additional reliability in that each station has at least one alternative means of telephone connection to the load dispatch office. This is achieved either by an alternative circuit over the direct power-line route or by tandem working through other substations.

The carrier and cable network, in conjunction with tandem working private automatic exchanges, allows calls to be dialled between any two extensions on the system and will ultimately extend these facilities over the rest of the country.

Power-Line Carrier Equipment

The carrier communication system employs G.E.C. type N multicircuit power-line carrier equipment, which has been designed especially to suit the varied communication requirements of electricity authorities.

Each terminal station is equipped with coupling equipment which injects the carrier frequencies into the power line and isolates the communication equipment from the power frequencies. This equipment has the frequency characteristic of a band pass filter, and couples the carrier frequencies to two phases of the power line, which then forms a balanced open-wire transmission line between terminal stations. The coupling equipment used for the power-line carrier network in Ireland has a pass band of approximately 145-285 kc/s.

The power-line carrier equipment for this installation uses a single-sideband suppressed carrier transmission, which has been chosen in preference to amplitude modulation or frequency modulation transmission systems because it permits (1) Economy of frequency space, (2) Reduction in circuit noise compared with amplitude modulated systems and f.m. systems occupying the same bandwidth, (3) Ease of maintenance, (4) Improved secrecy. (Any signal radiated from the power line is unlikely to be received intelligibly on a domestic radio set due to the absence of a carrier signal.)

Except for line noise, which even in the worst case does not seriously affect intelligibility, the circuits approach the standards more commonly associated with circuits provided by public telephone administrations.

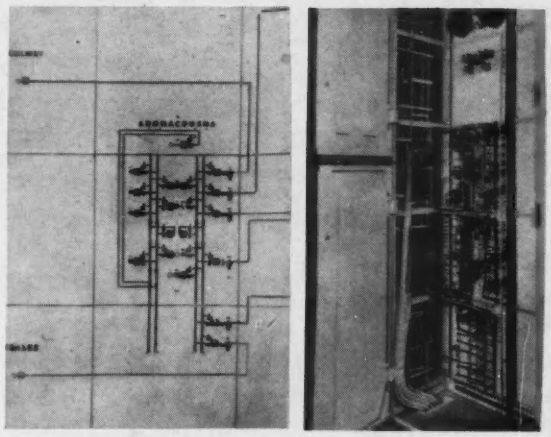


Fig. 3 left, a section of the wall diagram in the control room to show the representation of generators and transformers. Right Fig. 4, is a rear view of one of the wall diagram cabinets

Supervisory Equipment

The supervisory equipment translates the switching and loading conditions existing at remote parts of the power network into signals which are transmitted to the L.D.O. Here they are re-translated and presented in the control room on a wall diagram of the power network (Fig. 5). Any change in the supervised substation equipment is automatically displayed on the wall diagram, thereby providing the control engineer with complete information on the state of the network, enabling him to co-ordinate the operation of each station to the best advantage. The wall diagram, in the control room, comprises sixteen cubicles forming a continuous arc 60 ft long and 10 ft high. Any point on the diagram is easily viewed from the control desk at the centre of the arc. Every provision is made for future extension and development, as is illustrated by the multiple key mounting in Fig. 4.

The stations are presented in a semi-geographical layout on the wall diagram, the transmission lines and station busbars being represented by coloured lines indicating the different operating voltages. At each station, the principal equipment and its connections to the busbars, feeders, etc., are displayed on a mimic circuit in which the feeding conditions are indicated by the position of switch or circuit-breaker symbols. Illustrated in Fig. 3 is a schematic circuit diagram, as shown on the main wall diagram, of the Ardnacrush, a busbar system and switchgear.

The use of this system provides an operational facility of great flexibility and enables a continuous and complete picture of the behaviour of the whole network to be centralised in the Dublin load dispatch office.

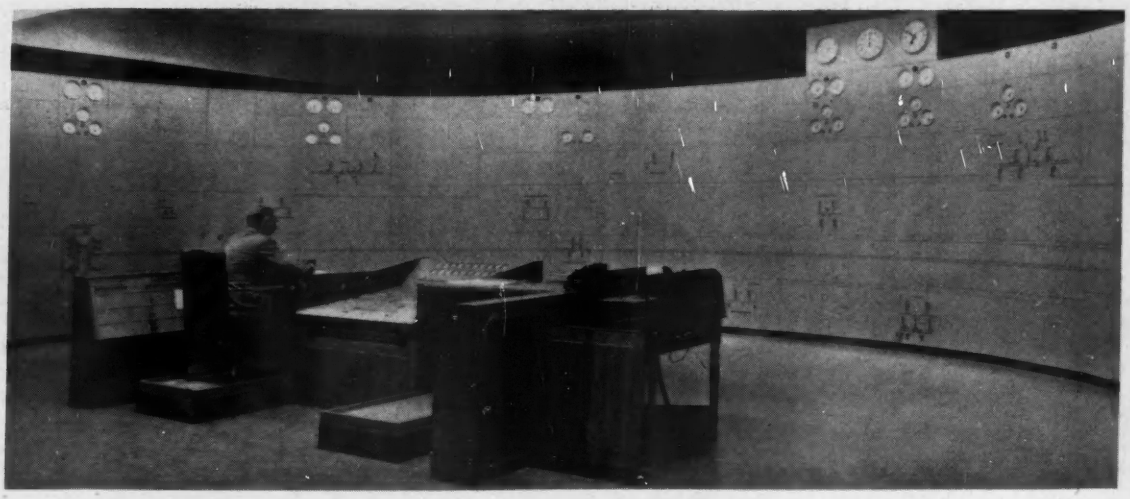


Fig. 5. The load dispatch office control room in Dublin showing the wall diagram control desk and key boards

District Heating Complaints

COMPLAINTS have been received from the Churchill Gardens Tenants' Association as to the cost and quality of the central heating system. This uses heat from two back-pressure turbo-alternators in Battersea Power Station and is the most modern of its type in this country. According to the Report of the Housing Committee of Westminster City Council the complaints were that the heating system was inefficient, necessitating the use of electric fires; that heating was cut off unnecessarily during the winter of 1953–4, due to the system of remote recording of room temperatures, which could not distinguish between space heating supplied by the District Heat Undertaking and that supplied by the tenant's electric fires; that the Council was paying too much for the heat supplied from Battersea Power Station, and that Dolphin Square Ltd. were not paying their fair share of the cost.

The Committee point out that there seems to be some misapprehension in the minds of the tenants in that they presupposed that the heat supplied to the Council was waste heat at Battersea Power Station and that it was provided at little or no cost. The charges payable by the Council were based on a three part tariff. An annual service charge to cover the interest and sinking fund charges on the cost of the turbo-alternators and anciliary equipment at the power station, a fixed charge for each therm supplied, to cover cost of operation and maintenance, and a running charge to cover the cost of purchase and handling of fuel. In view of the construction of the tariff only the fixed and running charges were under control of the Council and then only by control of the heat supplied. This could be reduced by the consumers by rigid attention to the elimination of waste heat.

It was apparent that in certain particular flats and rooms the heating was not always up to the standard prescribed by the Council, and the Tenants' Association and their members were asked to collaborate with the City Engineer in discovering and then remedying any such local shortcomings. To this end a simple "complaint" system had been set up.

To the allegation that the central control system could not differentiate between heat provided by the district heating and heat from electric fires, the Committee points out that the system used was in fact able to differentiate between the two types of heating, and during the 1953/4 season, the flats using electric fires could be identified. To clear up the difficulty, however, the Tenants' Association was being asked to co-operate in providing independent recording of of space heating in flats to be selected by the Association; and to this end the Council proposed to supply thermometers on loan so that tenants could record the temperature when they find it necessary to use electric fires, and also the room temperatures after the use of such fires.

Lessons from Boiler Inspection

UNDER the Factories Act, 1937, inspections of steam boilers are required to be undertaken by a competent person at least once every fourteen months. For many years, specialist boiler insurance companies have undertaken such statutory inspections, and the experience they have gained combines with the reports made by the Ministry of Transport inspectors where serious explosions have occurred, to teach many important lessons concerning boiler construction and operation. Some of the leading points brought out by such experience are discussed in a paper presented to the Institution of Mechanical Engineers last Friday by Mr J. Eyers, B.SC.(ENG.), M.I.MECH.E. (Chief Boiler Engineer, Vulcan Boiler and General Insurance Co.). He suggests that the principal defence against boiler failure is the employment of experienced inspectors acting in close co-operation with trained operating engineers.

Certification of boilers and pressure vessels still rests on the basis of visual examination together with hammer and hydraulic tests. However, special examination equipment, including magnetic crack detectors, gamma and X-rays and ultrasonic testers, is becoming increasingly important.

Water Level

The most frequent cause of boiler failure is damage occasioned by loss of water, and the reasons for such an incident are either neglect in the operation of water gauge or errors in the observation of water level. Even when boilers are under the charge of skilled engineers, accidents continue to occur owing to lack of the regular testing of the gauge. It is common to find steam or water connections choked with sludge and for replaced glasses to be so blocked with washers that a false water level is registered. If testing and observation of the water gauge is neglected, trouble due to low water is certain to be encountered. Automatic controls, although essential to the running of modern boiler plant, are particularly liable to introduce carelessness in the observation of water gauges, especially if there has been a long record of freedom from water level troubles. Mechanical faults such as the disintegration of floats and the blocking of orifices by sediment are accompanied as causes of trouble in such plant by the effects of careless maintenance, which may include incorrect reassembly after inspection. It is dangerous to rely on low water alarms to cover such eventualities.

Where boilers have to meet erratic load conditions, it is recommended that automatic recording steam flow meters should be installed, so that the operating staff have direct evidence of the output of their boilers. This must not, of course, exceed the maximum rated evaporative capacity.

One final failure may be quoted from this paper. It concerns a high-pressure feed-water heater, the nickel-chrome steel bolts of which were found in several cases to be cracked after six years' service. Close examination showed that the cracks were of a fatigue type, and that one of the principal causes of breakdown was the presence of water on the stressed material, this being due to the difficulty of keeping the cover joints tight in some conditions of operation. The water had caused a serious reduction in the fatigue limit, and also, by the production of pitting, had formed highly stressed centres favourable to the origination and development of fractures. It is suggested that when contact with water or steam cannot be prevented with components subject to stress variation, then a measure of protection should be provided by spraying or electroplating the surface of the steel with some more electropositive metal such as aluminium or zinc.

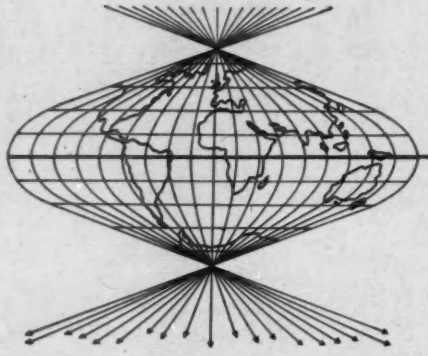
In concluding his paper, which ranges more widely than the examples presented in this summary, the author calls for more care to be taken in the training of boiler operators. In particular, attention should be given to ensuring their competence for dealing with an emergency. He considers that no matter how efficient an inspecting service may be, it is of little avail if subsequent staff supervision is lacking.

1954 E.I.B.A. BALL

WITH more than 1,100 guests attending, the E.I.B.A. Annual Ball held at Grosvenor House, London, on Friday last, created a new record: it compares with an attendance of 400 when the first E.I.B.A. Ball took place 20 years ago. Sir John Dalton, the Association's president, made this statement in thanking those present and the industry in general for making last year a record for the E.I.B.A. But he went on to emphasise that still more funds are needed. Later in the evening all present extended their good wishes to Sir John and Lady Dalton for the business trip to Australia on which they are leaving shortly.

During the evening dancing took place to Eric Robinson's Television Orchestra, and a Midnight Cabaret was staged. Forty prizes went to lucky programme holders.

1, The President, Sir John Dalton, greets Miss V. Norvick. 2, Lady Dalton is presented with a bouquet. 3, Messrs S. C. Hurry, S. Steward, E. S. Jones, left, J. Sanders, F. Farthing, A. S. Oldhams. 4, Mr V. Dale talks with Mr and Mrs Holland-Bennett. 5, Mr Goude buys a programme from Miss A. Goude, watched by Messrs Bailey and Bunting. 6, Mr G. M. Ham, Mr R. L. Sawer, Mrs Ross and Mrs Alston. 7, Mrs Bird, Mr W. Lewis Smith, and Mr C. R. King. 8, Messrs H. Oughton, A. Clarkson and M. Neville and their ladies. 9, Mr T. Bigland buys some programmes; at the table Messrs R. Chin and R. Bowtle. 10, Messrs N. V. Castling, A. L. Fielding and J. W. Wood, with their ladies. 11, Messrs Wilcox, Dickinson, and McKearney, with their ladies. 12, Messrs G. Falk, L. P. Houser, W. Thurner, R. Falk, Freedman and Grenville and their ladies. 13, Mr Joyce, Miss Neville, Mr Rogerson and Mr Kennett. 14, Mr and Mrs G. Ovens, Mr P. J. Squire, and Mrs Macalpine. 15, Mr and Mrs Todd, Mr Pratt and Miss J. Moore. 16, Dr S. Whitehead, Mr P. Thorogood and their ladies



OVERSEAS NEWS

A SUMMARY OF IMPORTANT EVENTS

CANADA

Distribution Improvement

An expenditure of $239,586 on extensions and improvements to the electricity distribution system by the Waterloo Public Utilities Commission, has been approved by the Hydro-Electric Power Commission of Ontario. The programme includes the purchase of advance frequency standardisation facilities from Ontario hydro, substation equipment and the installation of flat-rate water heater control equipment.

Looking Ahead

A ten-year plan for developing the hydro-electric facilities of Northern Manitoba, the expansion of present generating stations and the study of atomic energy and relationship to power needs of the province, was referred to earlier this month by Mr D. M. Stephens, general manager of the Manitoba Hydro-Electric Board. The possibilities for more hydro-power in Manitoba beyond 1960 were being considered by the Board, together with a plan for the installation of a fifth generator at the Brandon steam station. Among the schemes being studied are a power arrangement with the Hydro-Electric Power Commission of Ontario, and the development of the Grand Rapids site on Saskatchewan River at a cost of about $90 millions. If the latter was not found economically feasible there was a scheme for developing a fairly large site on the Nelson River, expected to cost around $60 millions, he added.

Power Export Row

Reports that Canadian Federal authorities were proposing to tighten their control over the export of hydro-electric power because they were dissatisfied with British Columbia's Conditional Agreement with the Kaiser Co. (to which we referred on 4 Nov.) has drawn forth protests from Mr R. Sommers, the B.C. Lands Minister. It has been reported that the Federal authorities intended to amend the existing regulations (under the 1907 Fluid and Electricity Exportation Act), making it necessary in such cases to obtain a federal licence. But Mr Sommers has declared that if the Federal government attempted that, British Columbia could construct the proposed dam itself, using money supplied by the Kaiser Co. He has said that a precedent has already been established—the Consolidated Mining and Smelting Co.'s storage project on the Kootenay River which benefited down-stream power plants on the U.S. side by 25,000 kW. In that instance the Federal Government did not interfere or suggest that the province should get compensation.

Another Milestone

The 100,000th consumer of the Manitoba Power Commission, who was recently connected, was also the 42,000th farm in the province to be given the benefits of electricity. The occasion was marked by an official ceremony when Mr D. Campbell, the Provincial Premier, switched on the consumer. The connection of the 42,000th farm has been achieved in nine years—good evidence of the remarkable progress of the Commission's rural electrification programme. The Commission, by the way, now has a network of over 29,000 miles of lines to serve 481 cities, towns and villages.

Expansion in B.C.

Gross revenue of the British Columbia Power Commission for the year ended 31 Mar. last jumped by 20% to a record $7,103,853. At the end of the year, the Commission served 52,773 consumers—of whom 44,321 were residential — a further 3,264 being connected during the year. After transferring $353,595 of the operating surplus to a contingencies reserve to write off the cost of reconstituting the Whatshan generating station which was severely damaged in two mud slides, the net surplus amounts to $177,572.

CENTRAL AMERICA

Cuban Project

Tenders for the construction of the first large hydro-electric plant in Cuba to harness the waters of the Hanabanilla and nearby rivers, will probably be called for about May, 1955, when the final report and specifications are expected to be completed. The construction and operation of the plant will be the responsibility of a new company, recently constituted, called La Primera Central Hidro-electrica de Cuba (PRICHEC). Authorised capital of the company is $2 millions of which $400,000 has been paid in, mostly by the Cuban Bank of Agricultural and Industrial Development (Banco de Fomento Agricola e Industrial de Cuba) (BANFAIC).

Power Loan

The Export-Import Bank has announced the granting of a credit of $750,000 to a Mexican power concern, the Cia Industrial Electrica Mexicana, S.A. This company, which distributes electric power in the Mexicali Valley of Lower California, is to use the credit to purchase United States materials, equipment and services to expand its facilities and meet the growing demand for power. The credit will bear interest at 5½% a year and be repayable in 20 approximately equal semi-annual instalments, beginning on 30 June, 1958.

BRAZIL

Consumption Tax

There is to be a new tax on the consumption of electrical energy in Brazil. The proceeds from this will go to a newly created Electrification Fund, which, it is intended will eventually be utilised by the other newly formed organisation, "Electrobras", (National Electricity Corporation) for the production, transmission and distribution of electricity, it is stated.

RUSSIA

Atomic Power

After claiming that Russia had put into operation in June last the world's first atomic electric power station, having an output of 5,000 kW, Mr Vyshinsky last Friday told the Political Committee of the United Nations General Assembly, that since then work continued on setting up similar power stations in Russia. He stated that Russia was building other atomic power plants to have capacities of 50,000 kW to 100,000 kW. He was scornful of statements made by United States spokesmen that it would not be possible to develop atomic energy on an industrial scale for twenty years.

EUROPE

Expansion Planned

A Spanish electricity concern, Saltos del Sil, plans to raise its output to 1,500 million kWh yearly in 1958, from an

estimated level of 300 million kWh this year, by harnessing the waters of the River Sil in north western Spain. Achievement of the 1,500 million kWh target will represent completion of the first stage in the company's plans; eventually it expects to produce some 3,000 million kWh per year. Saltos del Sil recently received two allocations of dollar aid; one of $300,000 for aluminium-steel cable and one of $153,800 for machinery. The company is at present constructing a 220 kV link between Galicia and Madrid to carry its expanding output to areas now short of electricity.

Revising the Regulations

A Commission has just been set up in Portugal to revise safety regulations for electrical installations. They will consider, inter alia, new problems connected with the planned electrification of the railways, with the electric underground railway to be built in Lisbon, and with the "atomic power stations" of the future (the latter being a possible development which may, according to the Under-Secretary for Commerce and Industry, have to be taken into account in preparing the next Development Plan).

Electrification of Greece

Summarising the progress of the plan for the electrification of Greece, Mr Rallis, Minister to the Prime Minister, has said that the Alivieri, Agra and Louros power stations had been completed, and were now producing 125,000 kW. The Larda power station, of 50,000 kW capacity, would be in commission shortly, while construction was about to commence on the Megdova and Ptolemais generating stations. But Mr Rallis warned that difficulties had been met in the erection of the associated distribution networks and it would probably be some time before many new areas could be electrified. The Agra hydro-electric plant for instance, which was put into operation a few months ago, is supplying electricity to Salonika, Edessa, Skydra and some rural areas in Western Macedonia, but the station is not running to full capacity as the Salonika distribution network is not yet completed. The station is also not yet linked to the national grid, but will shortly be connected when the transmission line from Edessa to Larissa is completed.

MIDDLE EAST

Turkey's Power

Indicative of the industrial expansion which has taken place in Turkey in recent years, are the official statistics of power generation. During the year ended 31 Dec. last, the country's power stations generated a total of 1,210 million units. The corresponding figure for 1940 was 397 million units. Of the former total industry consumed 64·3%, while domestic consumption accounted for 14·6%. Street lighting took another 3·1%, and tramways and trolley buses, 1·7%. Consumption of electrical energy per capita rose from 22 units in 1940 to 54 units last year.

INDIA

Industrialisation

Addressing the National Development Council last week, Mr Nehru, Prime Minister of India, said that India should give up the idea of importing machinery from abroad, and produce it at home. The main emphasis of the new five-year plan would be on industrialisation. He considered that there was plenty of room for private enterprise, but its role would be mainly secondary. In his view the means of production should be socially owned and controlled for the benefit of the society as a whole.

Inter-state Co-operation

The inauguration of the first phase of the Karnatak electric grid scheme operated by power supply from the Jog hydro-electric project, furnishes another example of fruitful inter-State co-operation in India. The scheme should have been inaugurated some time ago, but for the Mysore Government's demand for a rate which Bombay considered too high. The question was settled satisfactorily some three weeks ago when the two chief ministers met and discussed the matter.

Rural Electrification

The Madras State Cabinet has approved sixteen rural electrification schemes in the state, to cost about Rs. 6 million. Of these, four schemes, costing Rs. 1·3 million, will provide electricity to villages in Chingleput district; seven, costing about Rs. 2·1 million, in the districts of Salem, North Arcot, Trichinopoly and Coimbatore; two, costing Rs. 700,000, in Tirunalveli and Madurai districts; and three, costing Rs. 1·9 million, in Malabar, Coimbatore and Madurai. Provisions for the expenditure will be made in the 1954-55 Supplementary Budget demand.

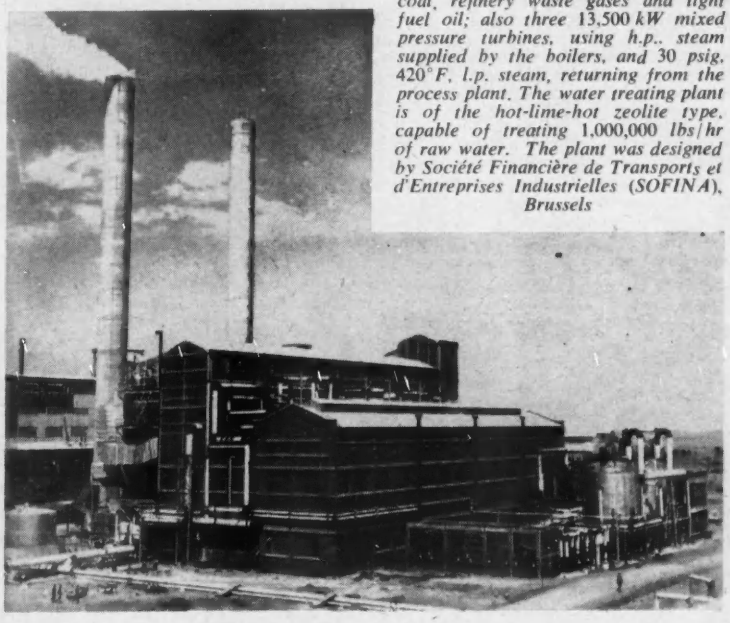
AUSTRALIA

H E. Power

Tasmania's output of hydro-electric power in 1953-54 was 1,404,238,916 units, the Premier, Mr Cosgrove, stated in the House recently. He gave the individual output from each station as follows: Tungatinah, 392,062,000 units; Waddamana A and B, 343,375,600 units; Tarraleah, 502,068,560 units; Butlers Gorge, 98,401,900 units; Shannon, 57,081,000 units; and Duck Reach, 11,249,856 units. Output from Tungatinah was liable to vary considerably between wet and dry seasons, but was likely to average between 35,000,000 and 400,000,000 units a year, he said. On completion of the Ouse River diversion to Lake Echo and the Lake Echo diversion to Tungatinah the reliable capacity of Tungatinah would be about 550,000,000 units a year.

Small Stations

In furtherance of the policy of the Queensland Government for providing electricity for small townships in the Western and South Western portions of the State, a new supply scheme was inaugurated at Bollon by the Attorney-General, Mr Power, recently. Supply is from an independent powerhouse which cost £23,000 of which the Government paid £13,000. It is expected that similar schemes will be operating at Capella and Yuleba before the end of the year.



Situated at Sasolburg (formerly Coalbrook), the new power station of the South African Coal, Oil and Gas Corporation Ltd., pictured below was put into operation a few weeks ago. The station is intended to supply electric current, steam and condensate for the process plant of this big oil-from-coal project. Installed in the station are four 370,000 lbs/hr, 575 psig, 820°F boilers, capable of burning pulverised coal, refinery waste gases and light fuel oil; also three 13,500 kW mixed pressure turbines, using h.p.. steam supplied by the boilers, and 30 psig, 420°F, l.p. steam, returning from the process plant. The water treating plant is of the hot-lime-hot zeolite type, capable of treating 1,000,000 lbs/hr of raw water. The plant was designed by Société Financière de Transports et d'Entreprises Industrielles (SOFINA), Brussels

Personalities IN THE INDUSTRY

Last week saw the retirement of **Mr Forbes Jackson,** M.I.E.E., M.I.MECH.E., from the position of deputy engineer-in-chief to the London County Council, which he had held for just over two years. Earlier he was head of the L.C.C.'s Electrical Division for some 19 years. He received his early training with Crompton and Co., and after a period with the B.T.H. Co., joined Merz and McLellan, serving both in their London office and in India. He went to the L.C.C. as divisional engineer (electrical) in 1933. He was promoted in June 1952 to be the senior divisional engineer and two months later became the deputy chief engineer. He has been prominent in the activities of the I.E.E., being chairman of the Installations Section in 1945-46, and represented the Institution on the N.R.E.I.C. in 1945. He was a member of the M.o.W. Post-War Building Studies Committee for Electrical Installations, and of the I.E.E. Codes of Practice Committee. In 1949 he was president of the Batti-Wallahs Society. Among other things, Mr Forbes Jackson directed the entire electrical installation for the Royal Festival Hall and the floodlighting of the County Hall for the Coronation.

Mr E. L. Hudson has been appointed manager of the Stock Sales Department of Davis and Timmins Ltd., at Wood Green. He was previously departmental purchasing manager with Kerry's (G.B.) Ltd., London, E.15.

Having reached the normal retiring age, **Mr E. Green,** M.SC., has relinquished his position as head of the Transmitter Advanced Development group of Marconi's Wireless Telegraph Co., Ltd. He is, however, continuing his work for the company on a full-time basis as a consultant engineer. The scope of the Transmitter Advanced Development group has been considerably increased and re-termed "Advanced Development," of which **Mr V. J. Cooper,** B.SC., A.C.G.I., M.I.E.E., M.BRIT.I.R.E., has been appointed chief engineer. Mr Green, who joined Marconi's in 1913, has more than fifty patents to his credit, and is the author of many technical articles. Mr Cooper joined the company in 1936 and has since been continuously associated with development work on transmitters, latterly television transmitters. More recently he has been working on the major problems inherent in the engineering of colour television cameras and transmission systems.

The Jackson Electric Stove Co. announce a re-arrangement of their technical representation in the area of the Eastern Electricity Board. As from 15 Nov. **Mr F. Woolnough,** who was until recently their technical representative in the North Met. and Essex Sub-Areas of the Board, has become responsible for Jackson sales in the Chilterns, Fens, Norfolk and Suffolk Sub-Areas. At the same time, **Mr A. G. Allen,** who has been their technical representative for the last four years in certain Sub-Areas of the London and South-Eastern Electricity Boards, has taken over responsibility for Jackson sales in the North Met. and Essex Sub-Areas of the Eastern Electricity Board.

Previously a buyer with William McGeoch and Co., Ltd., **Mr Duncan MacMillan** has been appointed B.T.H. lamp and lighting salesman in Glasgow, and will operate mainly in the Clyde area.

We are now able to reproduce below the photograph of **Mr A. D. Matthews,** A.M.I.E.E., who, as we exclusively reported last week, is shortly to take up the position of power station superintendent of the Marchwood power station, Southern Division, B.E.A. He at present holds a similar post at the Division's Portsmouth power station.

We offer our congratulations to **Mr W. Waddell,** northern representative for the Diesel Engine Division of the English Electric Co., Ltd., and to **Miss K. M. Higgins,** formerly housecraft adviser, East Midlands Electricity Board, Spalding District, on their marriage on Saturday last. Mr Waddell, by the way, is the second son of Mr J. Waddell, M.I.E.E., chairman of the D. P. Battery Co., Ltd.

Manager of the South East district, Birmingham and District sub-area of the Midlands Electricity Board for nearly six years, **Mr G. W. O. Ruscoe,** M.I.E.E., is to retire in Feb. next. Educated at Birmingham Municipal Technical School, he joined the Corporation Electricity Department in 1911 and has been associated with that undertaking ever since, apart from war service. Appointed high voltage consumers' engineer in 1923, he held that position until 1930, after which he was engaged on the large scale frequency changeover until 1938, for the last two years with the designation of frequency change engineer. That immense task involved an expenditure of about £3 millions. For the next seven years he held the post of h.v. construction and static substations engineer, and in 1945 he became deputy div. superintendent, being appointed to his present position in 1949.

Teddington Industrial Equipment Ltd. announce the appointment of **Mr F. P. O. Strange** as sales manager and **Mr C. D. Wenham** as contracts manager.

The Council of the Royal Society is to award a Royal Medal to **Sir John Cockcroft,** K.C.B., C.B.E., F.R.S., for his distinguished work on nuclear and atomic physics.

Mr H. Kline, M.C., A.M.I.E.E., has been appointed installation manager of William Steward and Co., Ltd., in succession to **Mr A. H. Jones,** who has retired. Mr Kline received education at the Poplar Technical College and followed this by an apprenticeship with Pinching and Walton, the contracting concern. War service in the R.E.'s was followed by appointments in the Chief Engineer's Department, London County Council, and in the Technical Division of Unilever Ltd. He

Mr E. Green

Mr V. J. Cooper

Mr A. D. Matthews

Mr G. W. O. Ruscoe

at present commands an E. and M. Squadron in the Army Emergency Reserve.

Mr T. Ward, who since 1953 has been assistant works manager at the Chesterfield factory of the B.T.H. Glass Works, has been appointed works manager (with effect from 1 Jan. next) in succession to **Mr A. E. Hill,** who retires at the end of Dec. Mr Hill went to Chesterfield when the factory was being built in 1923, and was its first works manager. Mr Ward was for some time production superintendent at the factory before becoming assistant works manager.

Superintendent at the Beckenham power station, London Division, B.E.A., since 1947, **Mr J. H. Padbury,** is due to retire on 21 Jan. next on reaching retirement age. He has served at that power station for over 43 years.

Londonderry Corporation Electricity Committee have recommended that **Mr S. A. Spence,** chief assistant electrical engineer, be appointed acting city electrical engineer, following the death of **Mr R. V. Macrory,** M.B.E., M.I.E.E. The committee decided that an advertisement be drafted for the position.

In the Brush works canteen at Loughborough, Leics., **Mr J. W. C. Milligan,** B.SC.(ENG.), M.I.E.E., M.AMER.I.E.E., who recently relinquished the post of managing director of the Brush Electrical Engineering Co., Ltd., received as gifts from his former colleagues a walnut wall corner cabinet, a carved walnut cocktail cabinet and a cheque with which to buy some silver articles. The presentation was made by **Mr J. H. R. Nixon,** M.I.E.E., M.I.MECH.E., F.I.I.A., technical director of the Brush Co.

Due to retire early in Feb. next is **Mr A. Willcock,** A.M.I.E.E., who has been station superintendent at the Barton power station, North West, Merseyside and North Wales Division, B.E.A. since 1948. He went to Barton in 1923 as charge engineer when the station began operating, and in 1929 was appointed assistant resident engineer there, being closely associated with the installation of much additional plant in subsequent years.

Mr Arthur S. Torrey has been elected chairman of Phillips Electrical Co (1953) Ltd, the Canadian subsidiary of British Insulated Callender's Cables Ltd. He was formerly vice-chairman of the company. Mr. Torrey succeeds **Mr W. H. McFadzean,** who has relinquished the chairmanship of the Phillips Company following his recent appointment as chairman and chief executive of B.I.C.C. **Mr D. W. Aldrich,** who becomes deputy chairman of B.I.C.C. on 1 Dec, has been appointed a director of Phillips Electrical Co. (1953) Ltd, and has been elected vice-chairman of the latter firm. Finally, **Mr T. A. Lindsay,** a director and vice-president of Phillips, has been appointed executive vice-president of that concern.

OBITUARY

Mr E. J. Frank, late managing director of E. F. Electric Ltd., died on 10 Nov.

Mr R. Falshaw, formerly head of the Harrogate electrical engineering concern of that name, died last week, aged 83.

Mr F. T. Allread, a former director of George E. Taylor and Co. (London) Ltd., died on 14 Nov.

Mr A. D. Constable, O.B.E., F.C.G.I., M.I.E.E., who retired in October 1937 from the position of director of electrical engineering at the Admiralty, died on 12 Nov. He gained early training and experience in industry before entering the Admiralty service in 1903. He was electrical engineer at Bermuda and Gibraltar Dockyards from 1904 to 1913 when he was appointed to the Admiralty. He became assistant director of electrical engineering in 1918, and for some years was employed on electrical design for the Naval Service and afterwards on research and experimental work. He was appointed director of electrical engineering in 1934.

Mr E. Skelton, tube mills manager of the Yorkshire Copper Works Ltd, Leeds, for 38 years, died on 14 Nov.

Mr J. R. Binns, secretary and a director of the Gatineau Power Co., died on 31 Oct.

TRINIDAD'S BIG INCREASE

PROVIDING a more economic power supply, the plan of the Trinidad and Tobago Electricity Commission to eliminate many of the small industrial private generating plants on the island, is rapidly progressing, we judge from the Board's report for 1953. During the twelve months ended 31 Dec. last, the Board sold over 71·3 million units—an increase of 28·9% on the previous year's figure. Of that total industrial consumption accounted for nearly 25 million units—a jump of over 53%, principally due to the fact that several large consumers found it more economical to take their supply from the Commission than to generate by their own private plant.

A further 3,965 consumers were connected during the year, raising that total to 21,018 at the end of Dec. last. Mr K. W. Finch, B.SC.(ENG.)., A.M.I.E.E., A.C.I.S., the general manager, points out that with consumers being connected at that rate the figure for annual load factor (54·1%) is somewhat misleading. The averaged monthly load factor for the year was 62·2% which compares with 54·7% in 1946. The aim is to still further improve the load factor, and to that end a Commercial Department has been formed to advise consumers on all aspects of electrical applications. This department has a service centre at the Commission's new head office, and is working in close harmony with Trinidad's electrical retailers. An electrical exhibition was held at Penal the week following the formal opening of the new power station there during the year covered by the report. To reach consumers in the rural areas a mobile service centre has been put into use and is proving extremely popular

On the engineering side the major event of the year was the completion of the first stage of the Penal gas-fired power station, details of which were given in our 29 Oct. 1953, issue. Work immediately began for the first extension, consisting of another 5 MW generator and a 60 klb/hr boiler, and orders have been placed for plant for a second extension to consist of a 20 MW set and a 215klb/hr unit boiler operating at 850°F, 625 lb/sq in. During its first five months of operation, the station generated 9,722,200 units, at an average fuel cost of 0·57 cents p.u. generated, and had an overall thermal efficiency of 22·7%. The Commission's older Wrighton Rd (Port-of-Spain) station was responsible for the generation of over 73 million units during the year, of which the three steam sets contributed 63·1 millions at an average fuel cost of 0·86 cents p.u., while the four diesel sets, totalling 6,290 kW, generated 9·8 million units at an average cost of 0·98 cents.

The Distribution Department also had a busy year, erecting over 100 miles of line, its main objective being the completion of three 33 kV ring mains equipped with automatic protection. The reliability of the 66 kV interconnected line between Port-of-Spain and Penal — on which there had been about two failures each month—has been greatly increased by the installation of an arc suppression coil at the northern end of the line.

The Commission has authority to distribute electricity throughout the island, except in San Fernando and Port-of-Spain. The former town has its own small station and in addition takes a bulk supply from the Commission, while in Port-of-Spain, the Corporation Electricity Board takes its supply from the Commission. The Commission is also developing its scheme to supply the island of Tobago. The first public supply was given to Scarborough in Sept. 1952 from 270 kW of diesel plant, and steady expansion is in progress. On that island also, the Commission is carrying out research, in conjunction with the E.R.A., to investigate the possibility of wind power generation.

It is evident from the report, that the Commission's undertaking is operating on a sound basis, and, with the comparatively low tariffs, a continuation of the steady expansion can be expected. Already the average consumption on the two-part domestic tariff is over 2,360 units per consumer per annum.

NEW LITERATURE

Practical Metrology—Vol. I

by K. J. Hume, B.SC., M.I.MECH.E., M.I.PROD.E., *and G. H. Sharp.*

EXPERIMENTS suitable for technical colleges are the main concern of this little book, which is the first of a promised series of four. In the introductory chapters there are notes on necessary apparatus and on the systematic method of measurement which can provide a sound basis. Thereafter, twelve simple experiments in measuration are described. Apart from its obvious usefulness to teachers in technical colleges, who may welcome detailed instructions for typical experiments, the value of the book lies in its critical approach. Both in the course of describing measurement procedures and in the conclusions presented at the end of each section, there is close attention to what is possible in the way of accuracy, and to the possible sources of error. Published by Macdonald and Co (Publishers) Ltd., 60 pages, 7¼ in. by 5 in. Price 6s.

Radio Receiver Design—Part I

by K. R. Sturley, PH.D., B.SC., M.I.E.E., SEN.H.I.R.E.

THE revised edition of this authoritative work will be welcomed, bringing to the reader information and explanation of developments and improvements since the book was first published eleven years ago. To those familiar with this work, little change in the main lines of presentation will be seen, but a wealth of new material has been added, whilst the revision includes a complete rewriting of chapter one to give a greater emphasis on the fundamentals of transmission and reception. Other revision takes place throughout but the book remains broad in scope, providing an eminently useful work for not only the design and development engineer's bookshelf, but also for the student's case. It introduces the subject with general considerations of reception and transmission, turning to an exhaustive study of thermionic valves used for radio work. The receiver is then considered in sections, fully discussing aerials, r.f. amplification, frequency changing and oscillators, i.f. amplification and concluding with detection. (Audio frequency work is considered in Part II). Published by Chapman and Hall, 667 pages, 8½ in. by 5 in. Price 56s.

Practical Electrician's Pocket Book, 1955

Edited by R. C. Norris.

IN this year's "Little Red Book" now in its 57th edition emphasis is given to the all-important task of improving the standard of electrical installations. To this end, new chapters have been added which deal with plans for the home, and increased use of electricity in catering, agriculture and horticulture. Wherever electricity is used there is work for electrical contractors; this leads to a demand for electricians who are trained to such a standard that they may be trusted to work without supervision. A new chapter on apprenticeship in the electrical contracting industry sets out complete information for anyone contemplating such a career and stresses the variety of work and experience to be had and the fact that fully-trained men are in constant demand.

Many other chapters have been revised and extended. Electronics in industry has an added section on servo-mechanisms; switches and control circuits, motors and control gear have been amplified, especially in the case of universal motors. A section on self-synchronous machines (Selsyn's) has been added, and generators and private generating plant have been revised to include regulation and parallel operation of alternators. This little book, always up to date, should prove as popular as earlier editions. Published by Odhams, 550 pages, 5½ in. by 4 in. Price 5s.

Electronics

by A. T. Starr, M.A., PH.D., M.I.E.E.

PREPARED as a textbook for the London University degree syllabus of the same title, this volume presents a largely mathematical account of the basic elements of light current engineering. It opens with a discussion of the physical principles involved, which progresses as far as an elementary approach to wave mechanics, and then comes a chapter in which the characteristics of the more common types of valve are considered. This leads on to an analysis of rectification, with the emphasis on waveform considerations. The two longest chapters in the book, follow dealing with circuit theory and with amplifiers, oscillators and detectors; the first of these chapters being concerned with passive circuits, while the second discusses relatively briefly the best known active circuits and their uses. A final section of the book covers applications outside the telecommunications field, including h.f. heating and control systems. Extensive appendices, covering 60 pages carry forward the mathematical completeness of the volume, while another feature that the student will welcome is a selection of exercises from past examination papers, accompanied by numerical answers where these are appropriate. Dr Starr's reputation as a successful author of textbooks for electrical engineers should be enhanced still further by this volume. Published by Pitman, 395 pages, 8½ in. by 5½ in. Price 32s. 6d.

Direct Current Circuits

by Earle M. Morecock.

THE growth of popularity of the M.K.S. system of units has led to the rewriting of many British textbooks, and it is therefore interesting to find that in the second edition of this American book similar practice has been adopted. Although likely to appeal mainly to the youngster who is interested in a career in electrical engineering, the aim has been to provide a course suitable for people of all ages; in consequence of this the mathematical treatment is not taken beyond G.C.E. ordinary level. Changes incorporated in this edition are rearrangement of chapters on measurements and expansion of network analysis methods. Generally, a solid grounding to the subject is provided. Units, measuring instruments, conductors, insulation, batteries, and electrostatics, among others, are all covered in this clearly written book. Ample illustrations, worked examples and problems are also provided. Published by McGraw-Hill, 388 pages, 9¼ in. by 6¼ in. Price 40s.

BOOKS RECEIVED

Telecommunications, by A. T. Starr. Further addition to publisher's Engineering Degree Series, covering the syllabus for this subject at the London University, and suitable for similar examinations. Published by Pitman, 454 pages, 8½ in. by 5½ in. Price 35s.

Power System Transients, ed. by E. Openshaw Taylor. Symposium contributed by leading electrical engineers providing a valuable book for power system and transmission engineers, and transformer and switchgear designers. Published by Newnes, 176 pages, 8½ in. by 5½ in. Price 21s.

Practical Lessons in Metal Turning and Screw Cutting, by P. Marshall. Guide to methods of using lathes for small workshops, motor repairers, model makers and amateurs. Second edition, published by Percival Marshall and Co., 178 pages, 7¼ in. by 4¼ in. Price 6s.

Directory of Manufacturers of Lighting Equipment. Drawn up by *Light and Lighting*, it lists names, addresses and products of 250 firms manufacturing lighting equipment, lamps and accessories. Published by Illuminating Engineering Publishing Co., Ltd., 35 Victoria St, S.W.1, 24 pages, 11 in. by 8½ in. Price 1s. 6d., post free.

Applied Electricity, by H. Cotton. This new edition of a popular text book, employs M.K.S. rationalised units throughout. Third edition, published by Cleaver-Hume, 488 pages, 8½ in by 5½ in. Price 1⅞s. 6d.

Whillan's Tax Tables and Tax Reckoner, 1954-55, by G. Whillans. Comprehensive guide to accounting and managerial staff for computing tax liability and allowances. Published by Butterworth, 10 pages, 9¼ in. by 6 in. Price 5s. net post free, reduced terms for larger orders.

PROBLEMS AND PRACTICE

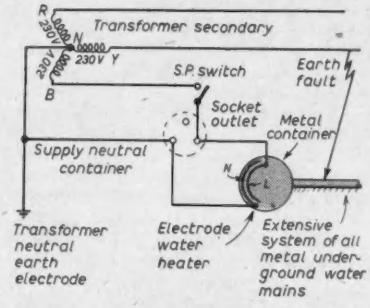
In Engineering

Every engineer has a story to tell; why not tell yours on this page? We welcome contributions to this feature, and those published will be paid for at our standard rates. Problems which are encountered and overcome in day-to-day maintenance or installation of electrical plant; useful methods and techniques developed for specific jobs, or current practices, all make instructive reading for others. We will also consider for publication problems requiring an answer. Sketches are often helpful and need only be rough, as they will be redrawn before use.

Electrode Water Heater

WHILST certain tests were being carried out in connection with suspected earth leakages, an electricity consumer reported that the water in a small electrode water heater had, on one particular occasion quite recently, commenced to boil without the control switch being "on." This water heater was permanently connected to the cold water system and used either as a cold or hot water outlet.

On test, the cold loading was one amp and the maximum boiling loading six amps, the supply voltage being 230 V nominal. A short length of twin t.r.s. flexible cord fed the heater from a 3-pin socket-outlet, the "live" side of which was controlled by a single pole switch. Subsequent tests disclosed that an intermittent earth leakage current of some 13 amps was flowing from some unknown source on the system and that the transformer neutral earth electrode resistance to earth was 13·5 ohms. The approximate cold resistance between the neutral connected electrode of the water heater and the earthed metal container was 270 ohms.



Circuit of the electrode water heater which resulted in water boiling without the switch on

To explain this state of affairs, it will be seen, referring to the diagram, that there are two parallel paths by which any earth leakage current could return to the transformer neutral point, one path being from the source of leakage via the transformer neutral earth electrode, and the other from the source of leakage via the metal container of the heater, through the water to the neutral electrode and thence via the supply neutral conductor. The earth leakage current should therefore flow through these two parallel paths in the inverse ratio of their respective resistances as 270:13·5 or 20:1.

Assuming the source of leakage to be from the "Y" phase to earth, and thus to the extensive underground water system to which all consumers' non-current-carrying metal work was connected, an earth leakage current of approximately 13 amps would give rise, at the start, to something in the order of 12·4 amps flowing via the transformer neutral earth electrode and about 0·6 amp via the electrode water heater. This latter current would cause the water in the electrode water heater to heat up, and eventually to boil. Readers will, of course, have realised that had the installation of this particular heater complied with I.E.E. Regulations 711 and 714, this sequence of events would not have been possible.—*E. A. Robbins.*

Lubricated Contactors

IT is the practice with many maintenance men to put "Vaseline" or some other lubricant on the magnet faces of a.c. contactors to cure mains hum or chattering of the magnet. This may be satisfactory in some ways, but it has been the experience of the writer that a number of minor breakdowns have been caused by having too much lubrication on the magnets which, with the addition of dust and fibres in the air, become gummed up, and cause the contactor to stay in irrespective of limit switches and overload relays. A case in mind was a 10 cwt chain hoist which was overwound to the extent that the limit switch housing was broken, the "up" contactor having stuck in. The contactor of horizontal spring return type was found to have quite an amount of a sticky substance on the magnet face. Enquiries proved that some time previous a spot of grease had been put on to prevent rust and cure chattering.

Another time a motor driving a photo-electric controlled process machine refused to stop, causing a considerable amount of jamming when the contactor, a gravity return type, stuck in, due as before to gumming up on the magnets. The effect of contactors sticking is not quite so troublesome on hand-controlled machines with an isolator available, as much as on unattended automatic plant where a good reliable contactor is essential.—*C. P.*

High Bars

AN unusual fault occurred on a 6 V, two-pole car starter motor. The first symptoms were just that it would not start with every indication of an open circuit. The design was such that the motor had to be dismantled to see anything so, on opening it up and finding that the brushes were a little shorter than seemed necessary it was decided that they were the cause of the trouble. New brushes were fitted, the motor reassembled and put back into position where it functioned satisfactorily for some weeks. When it failed again, the cover over the brushgear was removed with the motor in position and by inserting one finger it was possible to touch either brush, both appearing to be touching the commutator. The motor ran all right after doing this, so it was stripped again and this time the cause of the trouble was discovered.

Due to the confined space and the nature of the job the brush leads were short and only semi-flexible, which, coupled with one high bar on the commutator, showed what was happening. If the motor stopped with the high bar just before the top brush, the first move pushed the brush upwards, which, due to the stiff lead, then remained just clear of the commutator in spite of the spring provided. By carefully filing the high bar until it was level with the others it has since been possible to place absolute reliance in the motor starting each time it is required.—*H. T. W.*

Motors at Rest

WHERE motors are subject to seasonal working or the duty cycle involves long shut down periods "Megger" insulation tests should be taken to ensure that the windings do not deteriorate. This precaution is particularly necessary in the case of motors exposed to climatic conditions or where they are installed in a damp situation. The user is not always alive to the above points and in such cases, to minimise the risk of breakdown, the fitting of heaters to the motor is a worth while precaution.

Having gone thus far it should be appreciated that a warm motor standing for long periods is inducive to the nesting of rats and mice and open type motors are extremely vulnerable in this respect. Many cases have been observed of rats and mice being forcibly ejected when a motor has been started up and there is also the danger of winding insulation being eaten away resulting in serious damage. In cases such as this it is obvious to take steps to prevent the entry of vermin to the inside of the motor.

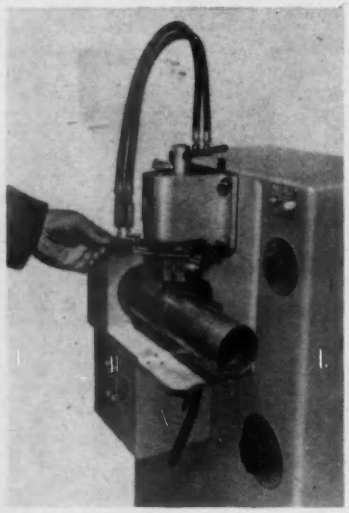
Rats and mice if given the opportunity, will frequently nest near current carrying cables, appreciating the warmth provided, and here again serious damage can result by the cable covering being nibbled away. Rats are notoriously "trap shy" and if normal methods of destruction do not eradicate the pest, call in experts quickly for the possible increase in rat population is fantastic.—"*Torque.*"

Equipment for Industry

Thin Tube Welding

SEAM welding thin metal components such as tubes or bellows requires special techniques and equipment. For some time the GENERAL ELECTRIC CO., LTD., Magnet Hse, Kingsway, W.C.2, have been manufacturing a 4 kVA electronically controlled equipment for spot-welding such assemblies and now a new machine which is a direct development of the spot-welder, is suitable for seams. Work is placed over a chrome-copper mandrel which forms the lower electrode and clamped firmly by means of a spring loaded ring section. Two levers bring the upper electrode disc and smoothing rollers into position and welding may then commence.

A three-position switch marked "off", "on" and "weld" controls the actual operation. With the switch in the "on" position a geared fractional h.p. motor drives the mandrel at a speed of 1 r.p.m., this continues when the "weld" position is reached. Spot welds of 0·02 sec. or 1 cycle duration are then applied every 2, 3 or 4 cycles, according to requirements, the intervals being electronically timed. As an example, with a tube having an overall diameter of 3½ in. welding speed would be 11 in./minute with 91, 68 or 55 spot welds per inch.

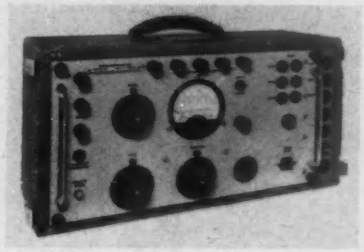


Tubes as thin as ·005 in. may be welded on this machine

A feature of the machine, is that it can be operated by an unskilled worker and a high degree of precision is claimed. Eccentric mounting of the upper electrode assembly, which is water-cooled, enables easy and quick movement to alternate working positions to be effected, so that seams spaced ¼ in. apart may be produced. Specific claims for the machine are that it will join two stainless steel tubes of ·015 in. wall thickness and for inconel or nickel this figure would be ·009 in. The minimum thickness for brass or copper in ·005 in. Using different mandrels for each diameter the machine can handle up to 6 in. Graduated scales enable recordings of currents and pressure to be made, the latter being variable between 25 and 150 lb/sq in.

Electrical Noise Measurement

TO meet requirements and recommendations concerning the measurement of electrical noise drawn up by the Comité Consultatif International Telephonique (C.C.I.F.) in 1951, an instrument known as the 74142-A Psophometer was produced by STANDARD TELEPHONES AND CABLES LTD., Connaught Hse, Aldwych, W.C.2. Since then certain improvements have been incorporated and the Type B instrument being produced is suitable for use as a valve voltmeter. Weighting networks for telephone and broadcast circuits are incorporated, and the instrument has a substantially flat response up to 12 kc/s. The instrument is compact and portable, and operates from a.c. mains. Frequency range is from 50 c/s to 12 kc/s and measuring range according to input voltage is from 0·05 mV to 100 mV.



This latest development may be used as a valve voltmeter

High Current Voltage Stabiliser

CLAIMED to be the first purely electronic voltage stabiliser having current rating as high as 2½ A a new equipment manufactured by SERVOMEX CONTROLS LTD., Crowborough Hill, Jarvis Brook, Sussex, is said to have quick response and high accuracy and regard to price. Good stability is achieved by using a balanced d.c. amplifier with stabilised heater and h.t. voltages. Drift with ± 10% mains supply variation is said to be within 5 millivolts. Particularly suited to work on lamps, valve heaters, small motors and magnets, the instrument has a range of 0-15 V d.c. output and ripple of not more than 3 mV is claimed for worst conditions.

A.E.G. activities in U.K.

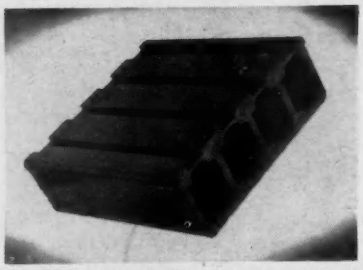
NEWS has been received that A.E.G. ELECTRIC CO. LTD., 131 Victoria St, Westminster, S.W.1, who early in the year announced their British-built motors, are manufacturing a range of alternators which are also made entirely in Great Britain.

Standard machines with salient poles, overhung exciter and A.V.R. are made up to 85 kVA at 1,500 r.p.m. with revolving armature, or alternatively where a revolving field is employed these figures are 125 kVA and 1,000 r.p.m. Voltage output is held steady to within ±1%.

For all independent and private supplies below 20 kVA, self-regulating alternators are recommended. These machines normally used for lighting, heating, cooking or radio loads, have a claimed regulation of ±2½% up to maximum output providing the p.f. remains near unity. When used on 0·8 p.f. loads, outputs are reduced slightly from the nominal and voltage is guaranteed to within ± 6%.

Extruded Phenolic Resin

THE technique of extruding rigid sections composed of thermo-setting resin presents extreme difficulty since it is during the extrusion process that curing of the semi-plastic resin takes place. It is therefore significant that such an intricate section as that illustrated has been produced. Specially manufactured by BRITISH RESIN PRODUCTS LTD., Devonshire House, Piccadilly, W.1, for MARRYAT AND PLACE LTD., this particular extrusion is being used in their "Barduct" system, which consists of busbars through trunking. Until now it has only been possible to extrude a section suitable for one busbar and therefore groups of four have been clamped together. The new extrusion has both reduced first cost and assembly costs.



Complicated though this section is, costs are lower than when four separate tubes are used

Lengths of this section are available to suit customers' requirements, the width is 4 in. This development represents a considerable advance in extrusion technique and the firm welcome enquiries for sections other than that shown.

Toy "Hoovers" for the Kiddies

REALISTIC toy models of well-known Hoover products are on sale in toy shops in time for Christmas.

There is a toy Hoover Standard model 612 cleaner, which, styled like its namesake, when pushed along, works by suction with a brush roller helping to beat the carpet. Price 29s. 6d. retail this toy is available from WELLS-BRIMTOY DISTRIBUTORS LTD., Progress Works, Stirling Rd, E.17.

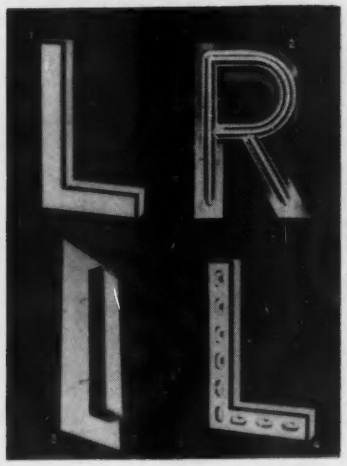
A toy "Dustette" battery-powered model of the real Hoover cleaner is available price 20s. 7d. retail complete with battery from the EVER-READY CO., (GT. BRITAIN) LTD., Hercules Place N.7. It takes up dust wherever it goes.

Third model is a Hoover Iron with which young daughters can help their mummies with the laundry. Price 7s. 9d. retail the iron is made by DIE CASTING MACHINE TOOLS LTD, 152 Green Lanes, N.13.

New Franco Signs

NEON letters employing plastic as medium for construction are amongst new sign letters available from FRANCO BRITISH ELECTRICAL CO., LTD, 15-17 King St, S.W.1.

First in our photo is the Lumore letter, a new letter in translucent Perspex. This material is used for the sides as well as the face of the letter the whole of which is evenly illuminated. The tube is totally enclosed so preserving the clean lines of the sign. The second letter is a "Veelite" letter in which the neon tubing is set into a V-shaped reflector of stainless steel which gives the impression of a triple tube letter. The face of the letter is also in stainless steel or English gold or silver leaf. "Halite" letters are made of translucent Perspex with metal returns and are designed for mounting a slight distance away from the facia to give a halo effect to the letter which can be illuminated in a contrasting colour. Fourth design is made throughout in translucent Perspex. Most of the tubing is enclosed but at intervals this has been made to protude through the face of the letter which is called a "Cerata" letter.



Left: Examples of new Franco neon signs

Ediswan Avon Range Extended

A RANGE of high quality a.c. shuttered sockets has now been added to the Edison "Avon" range of accessories by EDISON SWAN ELECTRIC CO., LTD., 155 Charing Cross Rd, W.C.2.

The new Avon switch socket

These are particularly suited for the conversion to electricity of old premises and are available in both 5 and 15 amp sizes in brown or white. Mounting plates are available for insertion between wall and switch socket to enclose completely the rear of the switch socket. Knockouts are provided for various sizes of cables whilst only two screws are required to fix both switch socket and mounting plate. Prices range between 8s. and 12s. 8d. each for sockets and 6s. 4d. per doz. and 8s. 4d. per doz. for mounting plates.

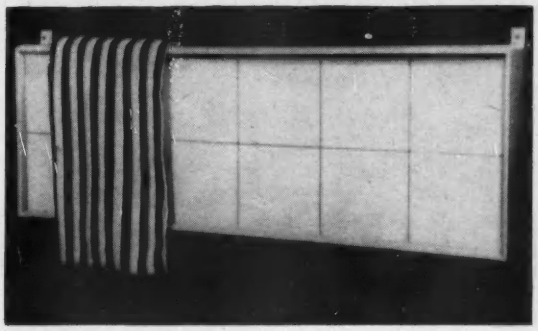
B.E.N. Spray Gun Outfit

THE "Handispray" spray gun just introduced by B.E.N. PATENTS LTD. P.O. Box 10 High Wycombe, is a lightweight portable set which can be carried in one hand, its total weight being only 45 lb. For this reason it is an ideal outfit for painters and decorators, poster and signwriters, and, of course, in small garages and workshops where the amount of work does not justify the use of larger equipment. Included in the equipment is a single cylinder air-cooled compressor displacing 2·58 cu ft/min. The motor is a Crompton Parkinson ½ h.p. unit direct coupled to the compressor and protected by a "Thermotrip" cut-out device. Model IM internal atomising pressure feed spray gun complete with quart container, 15 ft air hose and 15 ft 3-core cts cable complete the outfit which for a.c. supplies costs £37. 6s. 6d.

Panelair Non-Metallic Electric Airer

NEW arrival on the market is the "Panelair" towel rail and clothes airer by PANEL HEATERS, 77 Dean St, W.1. With low loading of 200 W the airer is said to have a high safety factor being completely non-metallic. The element is shrouded in an insulated envelope before assembly and gives an even temperature over the surface area of 135° F plus or minus 5°. Dimensions are 3 ft by 1 ft and weight 5½ lbs approximately. The Panelair, which is available in green or ivory tiled finish costs £7. 10s. 3d. including purchase tax.

Right: The non-metallic "Panelair" towel rail



For the Electrical Trade

Price Adjustments

SIMPLEX ELECTRIC CO., LTD., Broadwell, Oldbury, have just issued a gummed sheet of amendments to the Simplex switch and fuse gear price list publication No. SW 2040, which came into force on 8 Nov., except as previously reported the price adjustments on Cooker Control units (25 Oct.).

F. C. BLACKWELL AND CO., LTD, Great Crosby, Liverpool 23, have issued a temporary list of price amendments for Blaco conduit accessories which have been amended only where costs necessitate.

WM. SANDERS AND CO. (WEDNESBURY) LTD., Falcon Electrical Works, Wednesbury, Staffs, have announced that as from 1 Nov., the list prices in their Blue List and in booklet S 150, 151 and 153 are subject to an advance of 25% as against 20% except in the case of plugs and sockets on pages 30, 31, 32, 33 and 34 of the Blue List and the unbreakable plugs in Folder 152.

In contrast, however, the all-insulated consumers unit EG 613 (folder 149) is being reduced to a consolidated list price of 53s. 4d. (nett trade price 40s.), as against the current consolidated list price of 56s. (nett trade price 42s.).

TRADE PUBLICATIONS

TRAFFIC SIGNALS and components and equipment for traffic signal installation are described in a new brochure 1247 by Automatic Telephone and Electric Co., Ltd., Strowger Works, Liverpool.

PRODUCTION CONTROL.—Readers will be interested in the new booklet on Production Control issued by Powers Samas Accounting Machines (Sales) Ltd., Holborn Bars, E.C.1.

DOMESTIC APPLIANCES.—New Hotpoint Electric Appliance Co., Ltd., literature available from Crown House, Aldwych, W.C.2, and branches, deals with the Hotpoint washing machine, bedwarmer, and electric fires and takes the form of envelope stuffers.

RECORDING EQUIPMENT.—Leaflet 321 describing the new Cambridge Electronic Recorder is available from the Cambridge Instrument Co., Ltd., 13 Grosvenor Place, S.W.1.

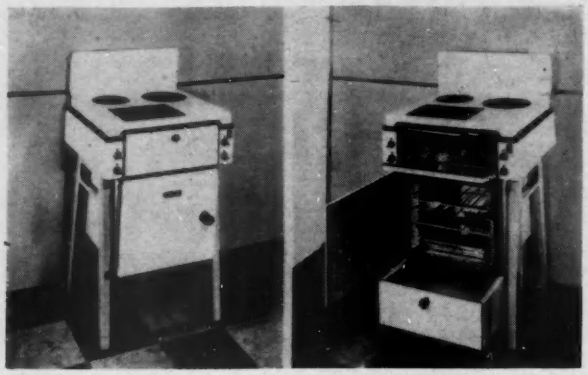
CONTROL GEAR.—Control gear for industrial and street lighting is featured in latest reprint of Section 7 Catalogue 18 issued by Revo Electric Co., Ltd., Tipton.

COOKERS.—A further leaflet dealing with the Creda Star Electric Cooker (Publication C. 2033) is now available from Simplex Electric Co., Ltd., Broadwell, Oldbury.

SIGNALLING.—Aldis Brothers, Ltd., of Birmingham, have issued an interesting booklet dealing with the versatile Aldis signalling lamp during the war years.

293

By *Jackson*



adds up to Better Cooking

LOGICAL development of the "Two-Ninety" low price cooker which scored such a big hit with its revolutionary design the "Two-nine-three" cooker just introduced by the Jackson Electric Stove Co., Ltd., 143 Sloane St, S.W.1, is the answer to a growing demand for a big sister to the "290."

Main difference of the new cooker is the extra large hob and provision of an optional storage drawer in the base. The plate includes a small 6½ in. dia. radiant plate which is controlled by a three-heat switch. A radiant plate is available with Simmerstat control as an optional extra whilst the oven is slightly larger at 12½ in. high by 16¾ in. deep and 12½ in. wide (depth of "290" oven was 13⅜ in.

As demonstrations have confirmed, the cooker will handle a meal for twelve people. Again the elements are placed at the sides of the oven near the base in order to give a good heat across the oven floor so enabling the busy housewife to use the full capacity of the cooker. Embodying the accepted high standard of Jackson products, these latest models comply with E.D.A.'s specification for interchangeability. The specification of the "293" is the same as that of the "290" which we reviewed in our issue of 5 Mar., 1953. The lift-off type hob is of heavy gauge pressed steel and finished in self-colour vitreous enamel which by its method of support allows spillage to drain into the hotcupboard chamber where it can easily be dealt with without in any way gaining access to the electrical equipment. Again the oven is of one piece welded sheet steel and is now finished in a lighter colour enamel than is usual. Loading of the elements is, however, greater than model 290 at 2,100 W so that with the extra small hot plate (1,000 W) the total loading of the 293 is 6,900 W. The legs of these cookers are of welded sheet steel and finished in impact-resisting stoved enamel, the two back legs being fitted with rollers for easy cleaning and maintenance.

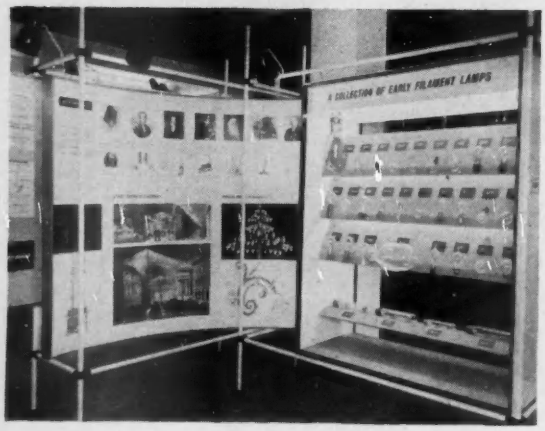
Colour choices available are cream with pale green legs, all cream, or white with pale grey legs and again a simple plug in splash plate is provided. Prices, which include splashplate and "Simmerstat" control on 8¼ in. plate are for Cat. No. 293 J, the leg model, £27. 10s. or for Cat. No. 293 JD, the model with storage drawer, £28. 10s.

Senior demonstrator for Jacksons, Mary Scallan, emphasised the special features which will "sell" the 293—excellent heat circulation in a specially steam-free oven, generous lagging to retain oven heat and even "browning" of oven dishes. The oven elements consume less, yet large size of oven permits more cooking at the same time and the grill boiler embodies special heat control.

B.T.H. open Mazda Showroom

CROWN House, Aldwych, is a commanding corner site in central London, a site passed by thousands every day and is an ideal place for the capital's latest bright spot, the new Mazda showroom just opened by the British Thomson-Houston Co., Ltd., to bring better lighting to the public eye. Next door to the domestic appliance showroom of the sister company, Hotpoint Electric Appliance Company, the new premises will feature attractive "walk round" displays on the many important facets of illuminating engineering. Principal feature of interest in our sphere is the use of the new "Invertrunking" as an integral part of the design of the showroom which bears evidence of strong contemporary design using lime, blue, grey, mustard and black panels to house fluorescent lighting fittings which give indirect lighting and can be moved about easily to illuminate any particular part of the room. Spotlights, "eye ball" fittings and "egg crate" louvering are used to effect to illuminate the present display which marks the third quarter-century of the electric lamp. This exhibition is devoted to the development of electric lighting since 1879 against a background of lighting through the ages and includes historic examples as well as push button "working" displays of contemporary lighting practice.

A unique collection of lamps on show covers the period 1880 to the present day. Earliest exhibit is a Phoenician oil lamp dated 1500 B.C. whilst latest are the horizontally operated M.V. discharge lamp and the 10 kW projector lamp, largest tungsten filament lamp made in Britain.



One of the current displays in the Mazda showroom, features the history of the electric lamp

Railway Communication

Speech Transmission to Engine Drivers

FOLLOWING the development of the "Clearcall" Industrial Communication system, and the many subsequent applications of the equipment in power stations, rolling mills, cement works, and many other industries, The British Thomson-Houston Company has developed a complementary "carrier-frequency" system for speech communication over existing power lines. One particular advantage of the scheme is that verbal messages can be transmitted between a fixed station on the ground and moving plant such as electrically-operated overhead cranes and transporters.

System Principle

Fundamentally the system makes use of the same principles on which all sound radio broadcasting is based—that is the transmission and reception of a high-frequency carrier wave which is itself modulated at frequencies within the audio frequency band. At each point where it is required to establish two-way conversation, a transmitter and receiver are installed suitably connected via protective coupling units to the existing power lines. In service, the transmitter (or modulator as it is more commonly known) behaves in much the same way as any conventional transmitter except that its output is fed to the power lines instead of an aerial; the receiver is tuned to the carrier frequency and by using conventional receiver circuits it reproduces the modulation as intelligible sounds in the loudspeaker. Because of the very strong signals available at the receiver input terminals—something like 1,000 times more powerful than those of a Very High Frequency radio link—relatively simple receiving circuitry can be employed with few valves.

The system is remarkably flexible and can be extended by using more than one carrier frequency. Six frequencies are available between 50 kc/s and 150 kc/s and any two or more of these six channels can be used without mutual interference. In fact, by means of selective-calling circuits which can be incorporated in the equipment, up to 36 simultaneous conversations can be held over the same conductors.

Although the link between the "transmitter" and receiver can usually be made via existing power conductors, it is also possible to arrange communication between places without any direct electrical connection at all. Such a system has been successfully demonstrated to the British Transport Commission in the marshalling yards of British Railways at Rugby and Sudbury.

Railway Application

The need for an improved method of communication on the railways—particularly in such places as marshalling yards—became apparent upon the introduction of diesel locomotives for shunting duty. For many years the system of communication between the shunter at the shunting bank and the driver of the shunting locomotive has been a code of pre-arranged signals from klaxon horns operated from the bank. This method served its purpose when steam locomotives were in vogue with their open footplates and exposed driving positions, but now that modern diesel, or diesel-electric, locomotives with their enclosed driving cabs are being used more widely, the drivers have experienced some difficulty in hearing the klaxon signals.

In the scheme developed by B.T.H. the locomotive is equipped with a combined demodulator and speaker unit which is connected to an aerial under the locomotive, the carrier-frequency signals being received from a wire laid between the permanent way. In this way, verbal and code instructions can be conveyed to the locomotive driver from the shunter without any fear of misinterpretation.

Orders have been received from the National Coal Board for similar equipment for the Manvers Main Re-organisation Scheme.

These demonstrations have been so successful that other applications of "Clearcall" carrier-frequency equipment are to be investigated on British Railways, including a trial on the electrified section between Sheffield and Manchester. On one part of this route it is necessary to assist heavy trains up the notorious Peninstone Bank by an additional locomotive pushing (banking) from the rear, but one of the operational difficulties of this practice has been the synchronised starting and stopping of both the leading and banking locomotives. In the proposed trial, each locomotive will be equipped with units for sending and receiving verbal messages over the 1500 V d.c. overhead supply wires thus enabling two-way communication to be established between the drivers of both locomotives. This scheme will be a similar arrangement in principle to that mentioned earlier for transmitting signals on the power conductors of cranes.

"Clearcall" equipment in the drivers cab of a diesel-powered shunting engine

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LOAD CARRYING TURBINE OIL

PERFECTO LC, a steam-turbine oil introduced by C. C. Wakefield and Co., Ltd. is specially developed to accept the high tooth loadings made possible by modern metallurgical and machining techniques in the manufacture of turbine gears. The lubricant, by meeting the Admiralty specification for turbine oils, can thus combine the two duties. Enhanced load carrying capacity is achieved by the introduction of an additive, which, in conjunction with a copper staining inhibitor, has no attack on brass or copper even at reasonably high temperatures. It is believed that the introduction of this oil will give added impetus to gear development.

NEWS OF THE WEEK

New Hope for Small Wholesalers

Customs and Excise may adopt New Policy over Registration

THERE would appear to be grounds for renewed hope among the smaller wholesalers and others who have been clamouring for registration with Customs and Excise for purchase tax. A series of events and hints in the past months indicates that a more lenient policy may be adopted by the Commissioners in the near future. The difference between being registered or not these days can involve, and indeed has involved, many hundreds of pounds, because registered traders are allowed to carry purchase-tax-free stocks. Those wholesalers who have had to pay tax when buying and find themselves with large stocks if and when P.T. is reduced or abolished on any article, have suffered heavy losses. Changes in tax rates do not, however, affect the registered trader because he does not pay the tax and can carry tax-free stocks. Consequently, of course, there has been in the past, considerable agitation by the non-registered wholesalers—agitation which has been renewed with added vigour and not a little anger at the time of alterations in P.T. rates. Their appeals have invariably been in vain because of the policy, hitherto, of not registering new applicants.

That policy is now likely to undergo a gradual change. The first hints that something might be done to alleviate the situation were given in the House of Commons during the third reading of the 1954 Finance Bill, but little has been made public since to give much encouragement. Then a week or more ago Customs and Excise issued a notice to all registered traders, the purpose of which was to prevent evasion of purchase tax and to enable the Department to adopt a more liberal policy over the registration of wholesalers. The notice states that in certain cases and to secure effective control the Department must have independent information as to any new sources from which particular registered traders are obtaining their supplies of chargeable goods. Registered traders are asked to keep a running record of all new customers buying chargeable goods tax-free as registered traders, and of all old customers similarly buying such goods tax-free for the first time as registered traders. In addition, talks which have been going on between Customs and Excise and trade organisations for some time, have now been completed. The ELECTRICAL TIMES understands that some relaxation in the present policy of Customs and Excise is contemplated and may be effected gradually, although no definite promises have been or are likely to be made. Nor is there any indication as to when any such change in plans will come about. The matter is purely an internal one for Customs and Excise officials and it will depend entirely on them how and when they change their plans. There is unlikely, of course, to be any "official announcement."

The present situation has developed from the Finance Act of 1944. As from 1940 everyone was registered, but in 1944 the Government decided it was not necessary to register wholesalers and Customs and Excise were given the option of registering traders or not. It would appear that the simplest method of collecting this tax was from the manufacturer, and this is what has been done.

ALL-ELECTRIC ESTATE TO LOWER RENTS

AN ALL-ELECTRIC housing estate is being suggested by the borough surveyor of Droitwich as the most effective economy which can be made to keep down rents of council properties. The proposal has been made in respect of the new Chawson estate where building is expected to begin next year to accommodate some 400 families. The suggestion has not yet been approved by the borough council, in fact nothing final has been decided upon. The development of this estate is being approached from the viewpoint of keeping rents low, and in order to carry out this aim the borough surveyor has been asked to draw up a list of possible economies. The surveyor's idea for the all-electric estate is the saving of money by omitting gas piping and fitments in houses. Gas mains will be run underneath the streets, however, so that tenants may connect their homes to the gas supply if they wish, at a charge of about £4 or £5. Examples of other economies proposed are reduction in the height of rooms, fewer cupboards, more houses to the acre, and fewer designs of houses on the estate.

7-Year Repayment Period wanted for Electric Cookers

TOPIC of discussion returned to the hire-purchase periods allowed for repayment of instalments on electric cookers, at the recent meeting of the S.E. Electricity Consultative Council. It will be recalled that only last July the Board agreed to extend the repayment period from three to five years, but some members of the Council want the Board to go a step further and make electric cookers available on terms that compared favourably with those applying to gas cookers. They are anxious that the period should now be extended to seven years.

Baghdad Trade Fair was Outstanding Success

EARLY reports from Baghdad following the all-British Trade Fair which closed on 8 Nov. indicate that achievements far surpassed even the more modest expectations. The results of individual firms' stocktaking after the exhibition are not, of course, available yet, but a good overall picture has been provided by Sir Norman Kipping, director-general of F.B.I. Some measure of achievements may be gained by the fact that comparatively little was brought back from the Fair—even the exhibits were purchased by the "hungry" customers. Sir Norman was unable to give an estimate of the volume of business done. Attendance exceeded 330,000, and as anticipated, visitors came from the Lebanon, Syria, Jordan, Saudi-Arabia, Kuwait, Persia, and from the Sudan, India and Pakistan.

Among those sections of the Fair which have already reported excellent business were the motor industry, the radio industry (including T.V. as far as Iraq is concerned), and the manufacturers of consumer goods, including domestic electrical appliances. In this connection exhibitors discovered the existence, hitherto unsuspected, of a middle-class in Iraq, with all that that means for the consumer goods industry. Sir Norman reminded British industry that the Middle Eastern countries between them have about £200 m a year to spend on development. He was quite certain that the U.K. had gained a start on her keen competitors in this market.

Postscript from the Fair

THE STORY of how an electrical firm came to the aid of the organisers of the Trade Fair has reached us from Baghdad. Just prior to the official opening by H.M. the King of Iraq a dust storm covered everything in the V.I.P. lounge with a thin layer of dust. Contact was made with Hoover Ltd.'s stand and along came two cleaners to clear up the mess and all was well at the opening.

An Even Bigger Electrical Exhibition

Over 230 Exhibitors at 1955 Show will occupy 250,000 sq ft

THERE will be over 60 new firms and an increase of more than 50 exhibitors over 1954 at next year's Electrical Engineers Exhibition to be held at Earls Court, London, from 15 to 19 March. Details of this, the fourth Electrical Exhibition, were given last week by the organising company, Electrical Engineers (A.S.E.E.) Exhibition Ltd. It was announced also that the Rt. Hon. Lord Citrine (chairman of B.E.A.) had consented to open the show. Total number of exhibitors in 1955 is expected to exceed 230, as compared with 179 last March. Next year, too, the whole of the ground floor of Earls Court will be utilised, raising the floor area of the exhibition from 150,000 sq ft to 250,000 sq ft. The B.E.A. and nine Associations will be taking part. As previously reported the main theme of the 1955 show will be the British Electric Motor. At the end of the hall there will be a display called Motor Way and a dais on which will be shown one of every type of specialised electrical motor made. Overhead will be an illuminated animated sign representing "motive power." Another special feature of the exhibition will be the entrance hall and foyer which is to be decorated with large illuminated photographs depicting electricity and motors at work.

Among improved facilities to be afforded next March will be an exhibitors and overseas visitors club, a reception room for overseas visitors with technical interpreters and new catering arrangements. Two awards will again be presented for the outstanding electrical, industrial and domestic labour saving equipment.

The exhibition will be open between 10 a.m. and 7 p.m. on each of the five days of the show with the exception of the Wednesday when a special late night is being arranged. The exhibition will close at 9 p.m. on that day. Further information and tickets may be obtained from Mr P. A. Thorogood, general manager of the organising company at 23 Bloomsbury Sq, London W.C.1.

RAILWAY SIGNALLING ORDER FROM S. AFRICA

EQUIPMENT for the remote control of signals and points at two new crossing loops on the main line between Cape Town and Johannesburg has been ordered by South African Railways and Harbours Administration from the Siemens and General Electric Railway Signal Co., Ltd. The loops are at Kromellenboog and Wildhoen and are about 16 miles apart. They will be controlled from a centralised traffic control machine at Britten, an existing crossing station about mid-way betwen them.

OFFICIAL PUBLICATIONS

OVERSEAS ECONOMIC SURVEYS

Honduras. HMSO 1s. 3d. (see this page).

Cuba. HMSO 4s. 6d.

BRITISH STANDARDS

B.S. 2518, 1954: Rotary Form-relieved Gear Cutters; B.S.2498, 1954: Recommendations for Ascertaining and Expressing Performance of Loudspeakers by Objective Measurements.

CHURCH HEATING. Published by Church Information Bd. (see page 734). 1s.

Impulse Generator for Cable Development

RECENTLY installed in the North Woolwich high voltage laboratory of Standard Telephones and Cables Ltd. was a 1,500 kV impulse generator which will provide essential facilities for the development of power cables and associated equipment. In future, investigations can be carried out into the impulse characteristics of all types of cables, high voltage capacitors and their constituent dielectric materials under accurately simulated working conditions. This will enable the materials to be used most effectively in the design of h.v. cables, and consequently has an important bearing on the economic development of these products. Impulse strength of h.v. transmission systems is particularly significant but similar knowledge concerning l.v. systems is also more than useful today. The generator has a maximum crest voltage of 1,575 kW and an energy output of 22 kW seconds. There are nine individual stages with connection in series or parallel as required.

India's Seven-week Industries Fair opens Next October

IN VIEW of India's growing demand for capital plant and equipment we note an important opportunity to be provided next year for UK manufacturers to show their goods in New Delhi. The Federation of Indian Chambers of Commerce and Industry are organising an Indian Industries Fair which is to be held over seven weeks from 29 Oct. to 15 Dec., 1955. It is being planned on an extensive scale and products of Indian industries will be shown. Foreign manufacturers of capital goods and machinery are invited to participate.

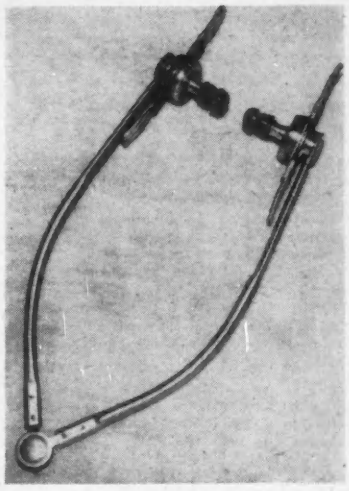
The Fair is to be held on the 65-acre site near the Delhi-Mathura Highway which was used last year for the Indian Railways Centenary Exhibition. The arrangement will consequently provide rail and station facilities, as well as water, light, power, and other amenities. Space can be reserved in the open at 3 Rs. per sq ft and under cover at 10 or 12 Rs. Those wanting to erect their own stands can do so in the open area. All applications should be submitted by 15 May to Secretary of the Exhibition Committee, c/o the Federation at 28 Ferozshah Rd, New Delhi.

Major Need in Honduras is Electric Power

LATEST in the series of Overseas Economic Surveys compiled by the Board of Trade deals with Honduras, but does not give a great deal of direct information for the U.K.'s electrical exporters. Opportunities there are, certainly, and it is by no means impossible to secure a larger share of the market at present supplied from the U.S. Progress in Honduras is limited by the finance that can be arranged internally because the Government is still reluctant to look abroad for development capital — it is the country's boast that they do not owe a penny. One of the major problems to be solved is the lack of adequate electric power. A hydro-electric scheme utilising the waters of the Rio Lindo is envisaged but a start has not been made and it is doubtful whether anything will be done until 1955. A major need in Honduras also is the development of transport facilities.

HEADPHONES WITHOUT WIRES

STETHOPHONE is the name given to a device which will reproduce sound by an induction method. Looking not unlike a stethoscope, from which it derives its name, the equipment has two earpieces which each contain a high permeability magnet assembly and have a volume control fitted. Weighing less than 2 oz. they are claimed to give no inconvenience, fit tightly over the ears and remove all extraneous noises. A wire running round the room and connected to the output of the wireless, via a small transformer, transmits the signals. The makers, The Magnetic Broadcasting Co., Ltd., envisage a variety of applications for this ingenious apparatus which requires no wires, battery or other attachments. The system can be used in a variety of circumstances, and, in fact, is now employed at the House of Commons.



The Stethophone which is likely to be in big demand for sound reproduction purposes

S. Wales Conference on Electronics in Industry

THREE-DAY conferences on "Electronics in Industry and Commerce" are being arranged in Swansea and Cardiff next February. They are being organised by the S. Wales Electricity Board and their purpose is to stimulate interest in new manufacturing techniques. They will be very similar to the highly successful conferences on Power Factor run by the Board.

The Swansea meetings will be held at the Patti Pavilion between 2 and 4 Feb. The first day will be allotted to the Board's staff in the Western and West Central sub-areas. On the other two days industrialists will be invited to attend, as well as various teaching organisations and E.C.A. members. The same procedure will be followed in Cardiff where the first day will be for the staff of the Board's Eastern and Central sub-areas. This conference will take place at the Drill Hall, Dumfries Place, from 16 to 18 Feb.

In both cases the conferences will be supported by an exhibition staged by the Board with ten manufacturers of electronic equipment. In the main, the exhibits will be working models. An hour's film show will be the special feature each morning.

Awards of Wiring Contracts cause Arguments at Two Council Meetings

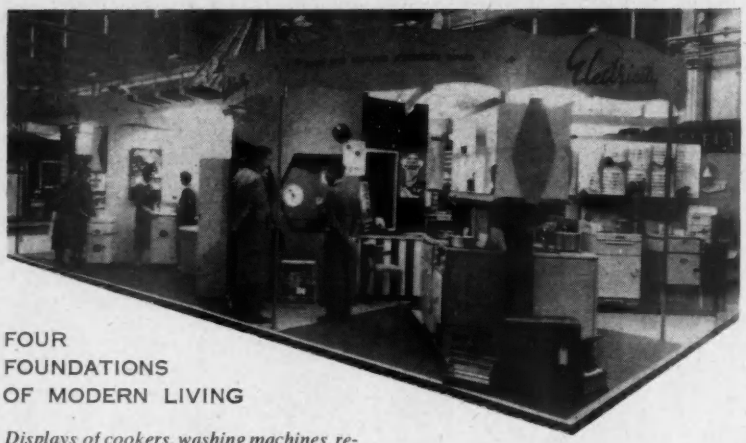
HEATED debates on the selection of tenders for the wiring of council houses took place at two council meetings recently at Reading and Haslingden. At Reading fourteen tenders were received for the wiring of 103 pre-war houses on various estates. The Housing Committee accepted the tender of the Southern Electricity Board at £1,556, but this was not the lowest received. It was stated that the lowest tender was for £1,313, the second for £1,440 and the third for £1,500. The fourth was that of the S.E.B. which had been accepted. The reason for this choice was that the lowest tender submitted was from a local firm who were considered incapable of carrying out a job of such a size. The second and third were from firms in Birmingham and Evesham and it was thought that difficulties might arise as regards contacting them for maintenance purposes should minor faults develop.

A reference back was moved by Councillor Busby who said that in work of this kind, provided the tenderer was considered capable of doing the job, the council had a moral obligation, if not a legal one, where tenders had been invited by public advertisement, to give the contract to that firm. It seemed common sense that when there was a contractor away from the town, arrangements should be made for him to do maintenance work during the six months' maintenance period. As it was, householders would be charged more than they need pay. (They will have to repay the cost of the installation over a period of years).

Chairman of the Housing Committee, Councillor Baker, pointed out that no committee was bound to accept the lowest tender. They had the responsibility of seeing that tenants received value for their money. In this case the difference between the highest and lowest tenders, £40 and £12. 10s. per house, gave food for thought. There were only two ways of getting out of a job if they under-priced it, and those were by doing an inefficient job or by not paying trade union rates. The council's officers had estimated the cost at £15. 16s. per house and the nearest to this was the S.E.B.'s price. He added that the difference in price could be saved time and again because the Board could be trusted to do the job properly, and they would be on the spot for maintenance.

Clr Bradley remarked that the council would have to consider the wiring of a further 1,742 houses later, and this matter would come up again. The matter was referred back for further consideration.

Arguments at Haslingden arose over the award of a contract to a private firm despite a lower tender submitted by the Corporation itself. The contract involved the wiring of 44 houses at Rising Bridge. Again 14 tenders were received, the lowest being submitted by the Corporation's Lighting Dept at £318. 14s. (next lowest was £372. 10s.). This price had only been submitted on the assumption that the Corporation employed an electrician for a year, it was explained. In that time the man would carry out repairs on other houses and if there was no work he would be employed in the Lighting Dept. The tender could not be recommended under those conditions. Nor was the tender for that particular job; £46 was added to it later. The opposition to the rejection of the Council's tender was based on the fact that a private enterprise firm had been "shown up" and the Committee merely wanted to find an excuse to reject the Corporation's price. The matter was referred back.



FOUR FOUNDATIONS OF MODERN LIVING

Displays of cookers, washing machines, refrigerators, water heaters, representing the four foundations of modern living were the basis of the S.W. Scotland Electricity Board's stand at Modern Homes Exhibition of 1954, held in Glasgow. Small appliances were exhibited in gay Perspex "egg boxes" in each section and illuminated by concealed fluorescent lighting. Advantages of an electric immerser were specially featured and this proved immensely successful because nearly 500 orders for water heating appliances were taken during the 17 days of the exhibition. Excellent business was reported from the stand as well as from the three electrical manufacturers who also exhibited, the G.E.C., the English Electric Co., and Jackson's Electric Stove Co. During the exhibition the finals of the Board's third Children's Cooking Competition was held. As in the past this contest proved popular and since September some 3,500 have competed in heats and preliminary rounds

I.E.E.'s Merseyside Dinner

SPEAKING at the annual dinner of the Mersey and N. Wales Centre of the I.E.E., Mr J. Eccles, deputy chairman (operations) of the B.E.A., deplored the shortage of science teachers. Mr Eccles is president of the Centre. He said the march of science had never been more rapid and if an acceptable existence for our 50 million population was to be ensured, the country could not afford to be behind in scientific knowledge and the ability to use it.

Mr Eccles went on to say that skill and inventive genius must be reinforced by a sound scientific education and a properly organised scheme for practical training. Adequate remuneration and prospects for teachers was the surest way to rectify the situation.

A.S.E.E. SOCIALS

DATES of two of the Association of Supervising Electrical Engineers' social functions were announced last week. Their Ladies' Night is to take place at the Trocadero Restaurant, London, W.1, on 25 Feb, the programme including dinner, dancing and a cabaret. The Association's annual dinner will be on 1 April at the Connaught Rooms, London, W.C.2.

Board Chairman explains Question of Local Rates

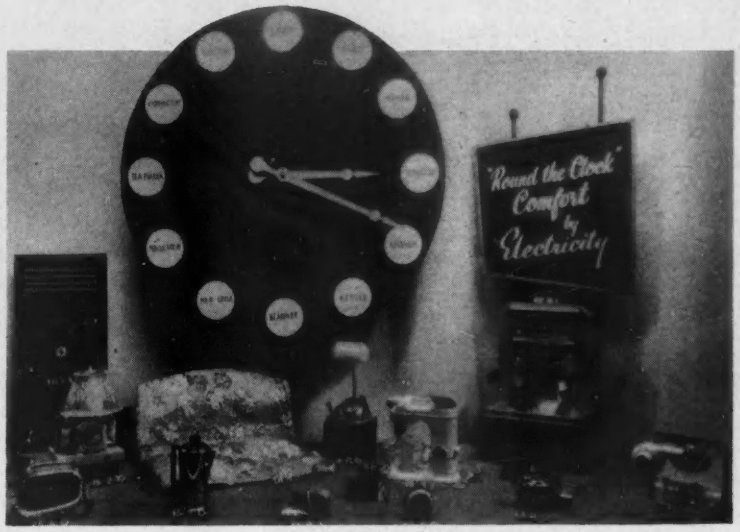
THE question of the payment of rates to local councils by electricity undertakings has been raised again. Stourport Council has decided to take up the matter of the Midland Electricity Board's new showrooms in the town with their M.P., Mr G. Nabarro. They allege that no rates are paid in respect of the showrooms and consequently they were losing some £30 a year. The Board's chairman, Mr W. S. Lewis, has replied to this allegation. He stated that although no rates were paid direct to local authorities, a substantial payment in lieu of rates was made each year. He explained that on nationalisation all rates paid by undertakings in England and Wales in 1947-48 were assessed and on that basis the B.E.A. and Area Boards paid a total of £11¼ millions in the first year. The money was paid to local authorities through the Ministry of Health. Mr Lewis said the annual amount had since risen. The Midlands Board last year paid out £671,910 in lieu of rates and in its six years total payments amounted to £3,926,072.

NEW COMPUTOR FIRM

A NEW subsidiary has been formed by J. Lyons and Co. under the name of Leo Computors to manufacture and deal in all forms of electrical and automatic computors, office machinery and automatic control equipment. The company has been registered (see page 766) but it is understood that this step was taken more to ensure the name than to carry out immediate development. Lyons' staff began to design and build their own electronic calculator, Leo, some five years ago. The machine is now handling the company's payroll and similar tasks, as well as being hired to other organisations. It cost about £120,000, and a second machine, on which a start has been made, is expected to cost about £90,000.

The First Half-Century

A club is to be formed in Birmingham under the name of the Birmingham and District Electric Club. Its object is to disseminate knowledge and information on electrical engineering and scientific subjects by the reading and discussion of papers, visits to works and other places of interest, and social intercourse between members. It was further resolved that ordinary membership should be open only to those engaged in the electrical profession, and who have had three years' experience, either applied or theoretical. The club-house for the present will be the Colonnade Hotel, New Street. Mr J. W. Inniss was elected president, and Mr M. G. Waggott, Engineering Branch, Post Office, Birmingham, hon. secretary.—*From our issue of 17th November, 1904.*



Display at Oldham which won the N.W. Board's seventh annual window display competition. The window was dressed by Mr W. Halliwell and Mr J. Gartside

Sub-Area wins Display Contest for Fifth Time

OLDHAM sub-area of the N. Western Electricity Board have added to their already long list of window display honours. For the fifth time of seven the sub-area (No. 3) has carried off the trophy in the Board's annual window display competition. On four occasions they have gained first place outright and on the fifth, in 1952, they shared the prize with Manchester (No. 2) sub-area. Successful competitors this year were the staff of showrooms at Oldham itself. Eighty service centres took part in the contest and once again the overall standard of display achieved was said to be very high. The set theme for 1954 was "Home Comforts." Displays had to be produced with a limited expenditure and had first to pass a preliminary sub-area judging before submission to the final panel.

Second place in the competition was awarded to the Wigan service centre. Other sub-area winners were Urmston (No. 1), Blackpool (No. 4), Darwen (No. 5), Whitehaven (No. 6) and New Mills (No. 7). In addition to those already named, five showrooms were particularly commended for effective displays achieved in spite of windows which were difficult to dress. These were at Eccles, Horwich, Whitefield, Padiham and Kendal.

Electrical Firms at Public Works Show

THE Public Works and Municipal Services Congress and Exhibition, now being held at Olympia, London, is devoted mainly to mechanical equipment. Electrically, there is comparatively little to be seen except in the fields of lighting and auxiliary equipment, generating units, motors and wiring systems. Firms exhibiting include Horstmann Electric Time Switches, Venner Ltd., Gowshall Ltd., Franco Signs, Brush Group, Atlas Diesel Co., Auto Diesel, The British Electrical Development Association, David Brown, Kango Electric Hammers, Newton Chambers, R. A. Lister, Ruston and Hornsby, Stanton Iron Works, Stewarts and Lloyds, Stothert and Pitt, and Warsop Power Tools.

Among the Congress Papers, the only one of direct electrical interest is "The Contribution of Lighting to Safety on the Roads" by Mr J. M. Waldram.

Increase in N.J.B. Salaries

At a meeting in London on 16 Nov. the National Joint Board for the Electricity Supply Industry approved a revised salary structure for application to certain members of the technical engineering staff of the industry. The revised structure provides increased salaries for about 15,000 employees governed by the N.J.B. agreement and is operative as from 1 July, 1954.

More Business meant Move Out of London

CONTINUED expansion of business in Greater London and the South has caused Claude Lyons Ltd. to move out of London to larger and more suitable premises at Hoddesdon, Herts. The company have acquired and moved to the office block and factory formerly occupied by Coloroll Paper and Bag concern. The new premises are fairly extensive, comprising about 11,200 sq ft and provides ample room for further extension. The new address is Valley Works, Ware Rd, Hoddesdon, and the telephone no: Hoddesdon 3007.

Serious Fire at Wednesbury Works

WE are glad to be able to report that Wm. Sanders and Co., (Wednesbury) Ltd., are recovering well from the effects of the serious fire which caused considerable damage in their warehouse and packing department. Many goods which were ready for despatch, and others awaiting packing, were destroyed. Nevertheless production recommenced almost immediately and normal routine was not disturbed as much as might have been expected. Some delay in the execution of orders, was, of course, inevitable, but we do not doubt that customers will appreciate the difficulties.

NEWS IN BRIEF

Over 120 attended the tenth annual dinner-dance of the Derby branch of E.I.B.A. It was reported that last year the branch contributed £480 to the Association's funds.

Global quotas for imports from Western Europe and certain other countries during the first half of 1955 of those goods still subject to import restrictions have been announced. Values remain unchanged.

S.W. Scotland Board have opened new service centre at Kirkintilloch. First customer was Provost Hugh Gillies who bought a refrigerator.

A special luncheon marked the silver jubilee of the founding in Glasgow of the Zenith works of Henry Wiggin and Co., Ltd.

Foremen of Johnson and Phillips Ltd, entertained members of the company and other guests at a dinner and cabaret at Woolwich Town Hall recently.

Supplies are now available of a new attractive Christmas window bill to publicise Philips Electrical Ltd's "Philishave."

Sayings OF THE WEEK

"In competitive personal salesmanship we are still underestimating both the quality and the effectiveness of the German overseas selling effort." . . . SIR HARRY PILKINGTON, President of the Federation of the British Industries, speaking on the British Trade Fair at Baghdad.

"If the Rt. Hon. gentleman went along now to an electricity showroom, and argued for solid fuel against electricity he would be thrown out on his ear!" . . . MR ROBENS, speaking in the House of Commons on the debate on the Report and Accounts of the Gas and Electricity Industries.

"Unlike western countries, which still considered there must be a time lag of some two decades before such atomic energy could become available on an economic or competitive basis with ordinary electric power, Soviet Russia had proved that fissionable materials could be so utilised." . . . MR VYSHINSKY, speaking in New York last Friday.

ELECTRIC SUPPLY NEWS

Farnworth

This Lancashire town which, before 1948, was very proud of the domestic electrification carried out by its own electricity undertaking (it had an "all-in" tariff of ½d. p.u.), is not quite so co-operative with the North Western Electricity Board, it would seem. On the council's post-war housing estates only 30 of the 500 tenants cook by electricity, it is stated, and the Board has complained that the sale of electricity does not justify laying underground cables. Unless there is a big increase in the number of electric cookers in future houses, the Board is to seek a contribution of £15 per house from the council towards the cost of laying underground cables. At present the council provides gas cookers in all their new houses, but reduces by 6d. per week the rents of tenants who have their own electric cookers. The Board feels that if that reduction was raised to 9d. a week the prospect of additional revenue would justify underground cables without a contribution from the rates.

Isle of Man

Douglas Corporation last week agreed to an exchange of bulk supplies between its own Electricity Department and the Isle of Man Electricity Board. It was explained that economies in generating costs should result if the Douglas area night load was carried by the Board's Peel power station and a proportion of the day load in the Board's area was provided from the Corporation's Pulrose station. In operating such an arrangement at the highest efficiency there should be a balance of about 5 million units a year supplied to the Board from the Corporation's power station. The council has agreed to operate this scheme for a trial period of one year. Subsequently the chief engineers of the two undertakings explained that the proposed joint operation was aimed at reducing generating costs, but there was little hope of tariffs going down. Mr C. Anderson, borough engineer and manager at Douglas, emphasised that the scheme was in the nature of a trial, but if after a year it was found to be a desirable development and it was sought to establish a permanent connection on the grid basis, a new arrangement would have to be made. Mr L. Douglass, engineer and secretary, Isle of Man Electricity Board, said an important feature of the joint operation was that it would increase the safety margin.

Leeds

The B.E.A. have applied for planning permission to erect a second 350 ft chimney, with grit arresting equipment, at Kirkstall power station. This proposed new chimney will replace six of the existing steel chimneys which are to be removed.

Newcastle-upon-Tyne

Replying to a letter from Newcastle-on-Tyne City Health Committee asking for the Authority's comments on a recent statement that severe atmospheric pollution would be caused when the new Stella North and South power stations were brought into use, the B.E.A. has stated that measures to reduce pollution included the provision of chimneys high enough to ensure adequate dispersal of fire gases, and the installation of grit collecting plant consisting of the most modern electrostatic precipitators. The manufacturers of this equipment gave a guarantee of 97·5% efficiency. These measures were the best known to deal with pollution. The City Health Committee has decided to install atmospheric gauges in the west end of the city for a period of 12 months before the new stations are in operation. The Ministry of Fuel and Power has also given an assurance to the committee that if there was any serious air pollution from the two stations the Ministry would certainly take action.

North of Scotland

The Moray distribution scheme of the North of Scotland Hydro-Electric Board has so far met with considerable apathy, it is reported. Apparently prospective consumers have been reluctant to commit themselves before the supply was available. As a result, the piecemeal additions had made necessary some modification of the orginal proposals and contract works, thus causing delay in the completion of the scheme, which is intended to provide power to about 2,000 premises, including 750 farms over 400 sq miles of Morayshire and Banffshire.

LIGHTING SCHEMES

Colchester. The T.C. has prepared a programme for improved street lighting.

Skipton. The council has approved an estimate of £4,818 for providing improved lighting on the main trunk road through Steeton and Eastburn.

St. Albans. It is hoped to provide an electric lighting system at the Saturday street market, at a cost of £1,000.

St. Austell. The U.D.C. has approved the expenditure of £1,055 on conversion of certain street lights from gas to electricity.

Tipton. The Borough council has objected to a £7,000 scheme for installing sodium discharge lamps along the half-mile stretch of the Birmingham-Wolverhampton New Road which forms the boundary between Tipton and Dudley.

Tonbridge. The U.D.C. has approved a £2,350 scheme for lighting Hadlow Rd.

INDUSTRIAL MAINTENANCE

A special monthly section of the Electrical Times

Commissioning and Testing ROTATING PLANT

By a Steelworks Engineer

WHEN rotating plant of any form is being put to work for the first time the initial checks will be concerned with the mechanical condition and alignment of the equipment. Motors and generators which have bearings carried in the endshields present a comparatively straightforward problem, since the internal alignment of the machine is fixed in the manufacturers works. The procedure for checking alignment will be identical to part of that involved in lining out machines of large capacity or slow speed when pedestal bearings are employed; in such cases the bedplate, bearings and stator frame really represent three separate alignment problems.

It is normal practice for machines to be erected in the manufacturers' works prior to despatch to site, and the various items should arrive complete with all the necessary shims and dowels, and with all parts carrying dowel holes which have been correctly reamered. In theory, therefore, to ensure satisfactory alignment it is necessary only to position the bed correctly and ensure that it is level, and then mount the pedestals and stator frame using the shims and dowels provided. Practice is not, however, necessarily as simple as the above might indicate because the bed may be distorted in transit, shims may be mislaid and manufacturers have been known to make errors in dowelling. As in all aspects of commissioning work an attitude of Cartesian doubt on the part of those responsible for site installation is strongly to be recommended.

This article is number 3 *in the series "Commissioning and Testing Plant." The first article appeared in "Industrial Maintenance of* 24 *June,* 1954, *and the second in the number of* 19 *August,* 1954.

Whilst it is, of course, possible to obtain a satisfactory line-out, if the bedplate is out of truth it is bad practice to attempt to do so, and the work is bound to take longer than if the bed is set truly level before erection proper is begun. In extreme cases when the bed has been badly twisted, it may be found impossible to make it level under its own weight; fabricated steelwork, as opposed to cast bed-plates, is more liable to this defect. The only solution is to secure the best possible level and ensure that the holding-down bolts will pull the bed into truth against an adequate arrangement of steel packing pieces; this offers obvious dangers and should be considered as a last expedient.

Alignment

A satisfactory line-out is obtained when, within the permissible tolerances, the half couplings of the machines being aligned are concentric and co-axial.

The allowable degree of misalignment will depend on the type of coupling in use and the speed of the machine. Generally with solid couplings a maximum tolerance of 0·0015 in. should be aimed at. Flexible couplings which transmit the drive through springs will permit a much larger figure—0·010 in. or even greater for slow speed machines below about 750 r.p.m.; it is, however, obviously preferable to try to obtain a closer alignment when the machine is being erected. For very heavy, slow speed drives such as mill motors which may produce several thousand horse power at 50/100 r.p.m. special types of coupling are often used which will allow of as much as 0·25 in. misalignment.

The alignment will be checked either by using a straightedge and feeler gauges or with a clock gauge. If the half-couplings are not truly circular or not bored at right angles to the face it will be impossible to use feelers, and a clock gauge will have to be used to take readings on the shaft itself. The alignment of the stator relative to the rotor will be checked by using feeler gauges in the air gap, taking readings from both ends of the machine; a tolerance of 10% of the gap length is usually permissible.

It is always desirable, and particularly when the machines are not mounted on a common bedplate, for the alignment to be correct with shims between the bedplate and all parts mounted on it. It is not uncommon for foundations to settle over a period of years, and if it is found necessary to lower the level of one of the machines at a later date it will be a fairly simple matter to do so if all that is involved is the removal of shims from beneath the bearing pedestals and stator frame. However, if there are no shims to remove, it will be necessary either to raise the machine which has sunk, or to machine some metal from the feet of the high machine, procedures which may be far from convenient.

Mechanical Troubles

Electrical machines do not present problems of intricate mechanisms and such mechanical defects as do occur are largely confined to bearing troubles. Probably the most common reason for the failure of ball or roller bearings is bad maintenance in the form of overfilling with grease or filling with the wrong type of grease. The result in both cases will usually be segregation of the lubricant from the base and the loss of lubricating properties. If at any time the type of grease used in a bearing is to be

changed, the old grease should be thoroughly washed out before the new type is put in.

Cases have occurred of machines developing bearing troubles whilst in store due to vibration being transmitted from the floor; if the rotor is stationary in one position for a long period it will in effect be supported by the same line or point contacts, depending on whether roller or ball bearings are in use, and

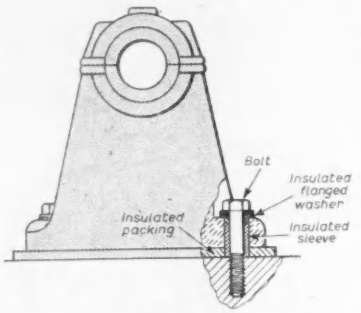


Fig. 1. Insulated pedestal mounting to protect machine bearings

the repeated vibrations will put flats on the bearing elements. Apart from the obvious desiderata for motor stores, they should be reasonably free from vibration.

If the machine is satisfactorily in service it is hardly necessary to carry out routine checks of the alignment. It should however be considered essential to check the air gap if there has been an electrical fault in or close up to the machine because unbalanced short-circuit currents may produce very heavy mechanical forces acting between the rotor and stator. A 5,000 h.p. 3·3 kV slip-ring motor flashed over from the overhang of the stator winding to the frame due to an insulation defect; the protective gear cleared the switch correctly and apart from the localised damage at the point of fault there was no distortion of the winding or other sign of mechanical stress. The stator frame was held down by four 1¼ in. bolts and located by four ¾ in. dia. dowels; the bolts had been sledged down during erection and the dowels were truly home. Despite these fixings it was found that the dowels had failed in shear and allowed the stator frame to move so that the air gap, nominally 0·100 in., had altered to 0·145 in. on one side and 0·055 in. on the other. The three-phase short-circuit level at this machine was 90 MVA at 3·3 kV.

A fault close to the terminals of a synchronous a.c. machine may similarly result in forces sufficient to disturb the stator/rotor alignment; induction motors which have comparatively a much smaller air gap may pull over enough for the rotor to rub the stator with results which will usually involve a complete rewind of the machine.

On large d.c. machines, stray magnetic fields may induce voltages axially between the two ends of the shaft; the p.d. so set up will tend to circulate current through the bearings and back through the pedestals and bedplate of the machine. These currents are dangerous because, although usually of low magnitude, in passing from the shaft to the bearings they will tend to pit the shaft and white metal shell, and to carbonise the oil. To avoid this effect it is common practice to insulate one of the bearing pedestals from the bed and thus break the electrical circuit in an arrangement such as that of Fig 1. Alternatively, if the weight of the armature is so great as to make the use of insulated shims undesirable the pedestals are fixed in the normal fashion and carbon brushes are provided to bear on the shaft and carry current directly to the pedestal without passing through the bearing itself. The integrity of the pedestal insulation or of the shaft brush system should be regularly checked.

Drying Out

The windings of electrical machines are impregnated and vacuum-baked during the course of manufacture, but if this process is followed by a prolonged

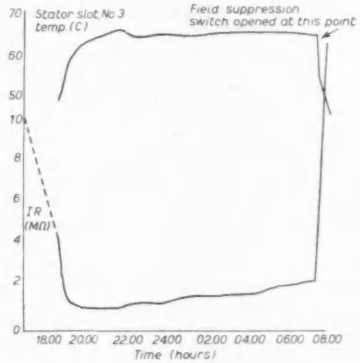

Stator slot No 3 temp (C)
Field suppression switch opened at this point
IR (MΩ)
Time (hours)
18.00 20.00 22.00 24.00 02.00 04.00 06.00 08.00

Fig. 2. Curve for dry-out of 5·5 MW 3·3 kV alternator

period of idleness there will be a tendency for the insulation to absorb moisture from the atmosphere. Such moisture will be more or less uniformly distributed through the thickness of the insulation but when current is passed through the conductor the heat generated will drive the moisture out and localise the low resistance path. The result will be that the insulation resistance will initially fall when the machine first carries current, and this will be followed by a steady rise as the moisture is evaporated. The effect is not serious for small machines, but the drop in insulation resistance may involve a fall to a dangerously low value for large h.v. units; in these cases it is necessary to dry out the insulation before the winding is made alive at full voltage.

The commonest and most convenient method of drying out an alternator is to run the machine with the stator short-circuited and circulate current through the winding. The precautions to be observed regarding the position of the short-circuit and behaviour of the exciter will be discussed later, but apart from these it should be borne in mind that the controlling factor during the dry-out will be the temperature of the windings. Machines fitted with embedded thermo-couples in the slots and in the stator iron will require no additional indications of temperature: when such thermo-couples are not available thermometers should be used to measure inlet and outlet air temperatures, the winding temperature and the stator iron temperature. To guarantee that the insulation will not be damaged by overheating it is preferable to consider the temperature of the hottest spot of the winding as 20° C above that of the highest reading thermometer. If the temperature is raised too rapidly the insulation may be damaged by an excessive rate of dissipation of moisture, and depending on the size of machine, about an hour should be allowed in which to bring the winding up to temperature; the temperature should be maintained as nearly constant as possible throughout the drying-out period.

Subject to these considerations the cooling system may be closed down during the dry-out, and the stator current may be adjusted to any desired value, although full load current or thereabouts will usually be found satisfactory: it is not essential for the machine to be run at its rated speed. The final value of insulation resistance, with the machine hot, should be equal to (rated voltage)/(rated kVA+1000) megohms. Nothing is to be gained, when this point has been reached on the rising portion of the insulation resistance/time curve, by continuing the dry-out: it will be found that the insulation resistance will rise sharply as the machine cools down. The rotor winding temperature may be derived during the dry-out from values of the rotor resistance; this can be calculated from the readings of rotor current and voltage, the latter being obtained by test prods bearing directly on the slip-rings. Fig. 2 shows a dry-out curve obtained in a practical case. It is impossible to predict with any degree of certainty how long drying-out will take, and the initial value of insulation resistance provides no guide in this matter. It is unusual for machines of less than 3 to 5 MW to take more than 24 hours drying out; for large alternators in central stations the dry-out period will run into days.

Drying Out Stationary Machines

It is not practicable to dry out a motor or d.c. machine by a short-circuit run, and if a dry-out is required it will be achieved either by passing a current through the windings from an external source, or by circulating warm air through the machine. The former method is preferable because the source of heat is within the insulation; it is,

however, obviously impracticable for the armatures of commutator machines. It is usually possible to pass a reasonable current through the winding from a l.v. supply by re-connecting the phases to give suitable impedance. If d.c. current is available this may prove a convenient source of heat. It is quite a feasible proposition to dry out a machine by passing warm air through it, though quick results should not be expected. A 600 h.p. 500 V d.c. marine propulsion motor had an insulation resistance of zero after a broken sea-water pipe had discharged itself into the armature. The motor was sheeted over with a space left at the top for the escape of warm air, and 2 kW of non-radiant heaters placed in the frame. An insulation resistance of 1 megohm was attained after 6½ days.

In cases such as the above, when the windings have been in contact with or immersed in water it is, of course, preferable to dismantle the machine and dry out in an oven. The alternative is, however, usually practicable, but the greatest care must be observed with regard to the amount of heat applied, because apart from the question of maximum temperature there is a limit to the rate at which moisture can be safely released from the winding. If this is exceeded sufficient vapour pressure may be generated within the coil to displace the taping or even burst the insulation. For small machines carbon-filament lamps are often a convenient source of heat.

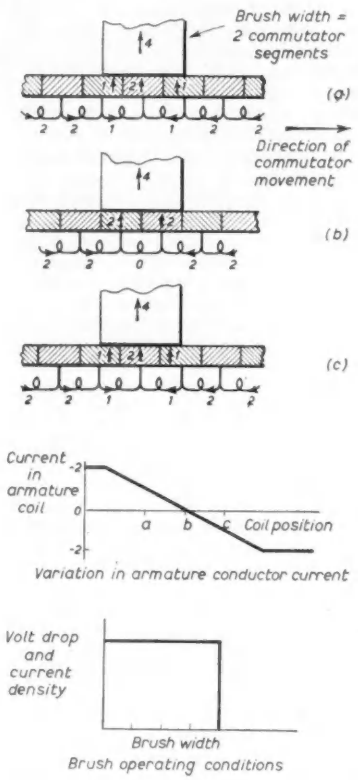


Fig. 3. Ideal commutation, current per brush, 4 amps.

D.C. Generators

With the exception of very small units it is unusual for modern d.c. generators to be driven by prime movers, and in the majority of present day applications an a.c. driving motor is used, either for straight a.c./d.c. conversion, or in a Ward-Leonard arrangement. Excitation arrangements are shunt, separate or differential compound, the latter being used where regenerative loads are likely to be encountered.

When the preliminary mechanical checks have been made, the insulation resistance of the armature and field circuits should be taken. The brushgear should be checked to ensure that it is on the marked neutral position, that all brushes are free in their boxes, correctly bedded, and of the right grade with the correct spring pressure applied, and that all brush tags are tightly secured. The field rheostats, if any, should be tested to check that their "raise" and "lower" markings correspond to strong and weak fields respectively, using an ohmmeter or an ammeter in conjunction with an external source of supply. The machine may now be run up and the open-circuit characteristic taken, the field current being cautiously controlled during this process. Where multi-field generators are concerned, as in Ward-Leonard loops, each field should be treated separately, as previously described under the heading of "feed-back control schemes." The performance of the machine on load may next be observed, the particular point of interest, apart from the mechanical condition being, of course, the behaviour of the brushgear. The question of commutation will be dealt with later, but it should be observed at this stage that it is most undesirable for the generator to run for prolonged periods on no-load with the brushes in position; if this is done a glaze will be formed on the commutator and there will be a tendency to chip the edges of the brushes. A large three-generator Ward-Leonard-Ilgner set ran extended trials in this condition whilst the driving-motor was being commissioned and bearing adjustments carried out; it was subsequently found necessary to renew the brushes on all three machines due to the cracked edges on all the original installation. If a no-load running period of more than 4 or 5 hours is contemplated, a situation which frequently arises with large sets, this should be carried out with the brushes lifted.

D.C. Motors

The preliminaries to commissioning d.c. motors will be similar to those already described for generators, particular attention being given to the integrity of the field circuits. Shunt, series and cumulatively-compounded machines all find their application in modern practice, the use of separate excitation being largely confined to motors used in Ward-Leonard systems. The motor should be run up for the first time after a check has been made to ensure that full field and reduced armature voltage will be applied when starting, and after the usual precautions have been observed in regard to checking the brushgear and mechanical condition of the machine. When compound wound field systems are involved it is desirable to let the machine start first as a series and then as a plain shunt motor in order to check, from the direction of rotation, that the fields are connected in the correct sense. The troubles of d.c. motors are generally similar to those encountered in d.c. generators, and centre chiefly on the commutator and brushgear; the question of commutation is discussed in the section of the article that follow.

Commutation

It is the Author's experience that commutation difficulties in d.c. machinery can present more varied and more complex problems than any other one aspect of heavy electrical engineering, since there are so many possible causes of bad performance. It will first be desirable to see the conditions that result in perfect commutation.

The current in the armature conductors alternates with their passage over each pole pitch, and the reversal of current takes place when the conductor is on the neutral axis: this point should correspond to the position of the brushgear, as shown in Fig. 3. The current density should be uniform over the width of the brush, and the e.m.f. in the short-circuited coil should be exactly equal to the sum of the volt drops in the brush contact, the segments and the short-circuited coil itself.

In practice the effect of the armature reaction is to distort the main flux so that the neutral axis is shifted, in the case of a generator, forward in the direction of rotation; in the absence of interpoles the brushgear would have to be moved by a similar amount. Further, the coils adjacent to that undergoing commutation produce e.m.f.'s which tend to oppose the change of current in the short-circuited coil, an effect which is reinforced by the self-inductance of the coil itself. In order to overcome these e.m.f.'s the brushgear must, in the case of a generator, be further advanced so that the coil under commutation will be in a magnetic field of strength and polarity adequate to induce in it a voltage of the required value. The function of the interpoles, is, of course, to produce the field necessary to induce the voltage in the short-circuited coil and to counter the armature reaction, with the brushgear remaining fixed in the no-load neutral position. In heavy reversing drives, such as large rolling-mill motors, the latter effect is sometimes provided by pole-face compensating windings, and in machines such as these, the interpoles provide only the flux for the short-circuited coil.

Split Brush Commutation Tests

It is apparent that optimum commutation will result in an even distribution of current throughout the brush, and conversely that a variation in current density will indicate either over or under-commutation which may or may not result in sparking. A check may conveniently be carried out by determining the voltage drop in the brush along its circumferential face, by the method shown in Fig. 4. One brush is removed from its holder and replaced by two, or preferably three brushes lightly insulated from each other and from the

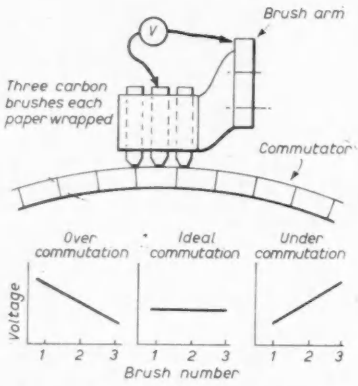


Fig. 4. Commutator tests. At least two brushes should remain in service on the arm to which the split brushes are fitted

brush box; these can consist of standard brushes cut down to width and wrapped with paper. A voltmeter placed between each split brush in turn and the brush arm will then indicate the drop in the contact, brush and connections of all the other units mounted on the arm, i.e., will produce the diagrams shown in Fig. 4. From these it can be decided how the commutating field should be adjusted either by brush shift or by variation in interpole strength. The latter should not normally be necessary on site unless a machine has been completely re-built, but may be accomplished by using diverter resistances or by varying the air gap of the interpoles.

The use of split brushes demands no more than reasonable care on the part of the engineer to secure results in safety, and is in the Author's opinion strongly to be preferred to any method which involves the use of test prods bearing on the commutating faces of brushes. If the brush boxes are staggered to give a wider arc of contact for each arm, two sets of split brushes should be used, to cover the whole of the contact arc.

Commutation Troubles

Probably the most common causes of bad commutation, apart from armature faults, are the use of the wrong grade of brush, the application of incorrect brush pressure and slackness of the pig-tail connections. Any of these defects can result in selective action, when one brush tends to take more than its fair share of the load on the brush arm; in extreme cases the current taken can be so high as to result in the brush being raised to incandescent heat. In any event the effect on the commutator will be adverse, and regular checking of the connections and brush pressure to ensure that the springs are following up the wear of the brush, should be an essential feature of the maintenance routine.

The use of brushes of the wrong physical dimensions will obviously lead to trouble, since if the clearance to the brush box is too small it will tend to jam and the correct pressure will not be applied, whilst if the brush has too much play it is liable to chatter and damage both the brush face and the commutator. Badly grooved commutators and high micas complete the list of the more usual causes of bad commutator performance. However, circumstances may arise, particularly when a machine has been re-assembled after repair, when all the above may be eliminated and further investigation will be required to find the source of the trouble. A reversed or short - circuited interpole will cause sparking at the brushes, and may be checked by reading the voltage-drops across each interpole coil or by using a pocket compass on the outside of the yoke. A defect in the main field system will have a similar effect.

The brush system as a whole should be in the neutral position but if the spacing between the brush arms is not equal, a true neutral cannot be found. The brush arm spacing should be checked by wrapping a piece of paper round the commutator and carefully marking the positions of corresponding brush edges on each arm; the paper may then be removed and the distance between marks measured.

It is possible for selective action to occur between brush arms, when there is more than one for each polarity, due to variations in resistance in the material of the arms themselves or to high resistance joints in the copper-work connecting the brush arm to the output terminals. The load carried by each arm can be checked with a millivoltmeter reading the fall of potential across corresponding points within each of the brush arms.

Commutator Maintenance

The commutators of modern d.c. machines should require practically no maintenance provided that the working conditions are satisfactory, apart from occasional undercutting of the mica to keep pace with the wear of the copper. However, under adverse conditions the commutator may ridge or develop flat spots which will result in bad commutation or chipped brushes or both, in which case remedial action must be taken.

Since the brushes are required to bear on a surface which should be true when rotating at rated speed, it is always preferable to correct the surface irregularities when the armature is turning in its own bearings at that speed. This may not always be convenient for example, with small endshield bearing machines, and the only alternative is to remove the armature and turn it in a lathe. Ridges can be removed by a hand stone applied to the commutator in position, but this method will not remove flat spots. Considerable skill and experience is required to obtain satisfactory results by hand stoning, and unless this skill is available the method is of doubtful value; it is in any event unlikely that the finish will be comparable to that of diamond turning or grinding.

Grinding

When a commutator is to be ground in situ some means must be available to turn the machine at or near its rated speed; this presents no difficulty for generators, but motors must be driven temporarily from an external machine. In the case of very large motors it may be possible to remove all the brush arms but two, and rotate the machine for grinding purposes by applying a reduced voltage to these two arms. It is desirable to seal the commutator risers against the ingress of copper dust by firmly fixing a cloth barrier over the whole periphery. The grinding gear must be rigidly mounted and as free from vibration as possible; it should be set so that it is true, within 0·001 in. or so, to the outside edges of the commutator which are not tracked by any brush, so as to grind a profile parallel to the original surface. If the brushes bear over the whole width of the commutator there will be no true surface left, in which case the best compromise must be chosen, and the risk of a slightly conical profile resulting must be accepted. If the mica becomes proud of the copper during grinding, the difference in the two materials will tend to cause the grindstone to shudder and mark the copper. Should there be any doubt in the matter it is therefore preferable to undercut the mica before grinding is commenced; it may otherwise be necessary to stop in the middle of the process in order to lower the level of the mica.

The amount of feed and speed of traverse of the grindstone will depend on local conditions, but in general a light feed and the fastest speed of traverse practicable should be used. If a heavy feed is applied there is a danger of excessive vibration, and also the rate of wear of the stone may be increased without corresponding advantage in the removal of copper. A coarse grade of stone may be used initially, and a finer grade for finishing, the final polish being obtained with emery cloth. The mica may then be undercut and the machine thoroughly blown out before replacing the brush-gear.

Traction Motor Maintenance

INSPECTION, REPAIR AND OVERHAUL ROUTINES USED BY LONDON TRANSPORT DESCRIBED IN I.E.E. PAPER

Maintenance of all electrical equipment has much in common. Perhaps d.c. traction motors are amongst the machines having the most peculiarities from this point of view, but even if this is admitted there is still much to be learned by all plant engineers from the arrangements made for the overhaul and maintenance of such machines by one of the largest users in the world, the London Transport Executive. The article presented here is based on a paper which one of the officers of that Executive, Mr J. G. Bruce, B.SC., M.I.E.E., read last Thursday to the Institution of Electrical Engineers in London.

MAINTENANCE on the 600 V d.c. traction motors in use by London Transport consists principally of inspection of commutators and brush gear, including brush changing where necessary, greasing and inspection of bearings and gears and periodic testing of insulation. Greasing in the case of the more modern motors fitted with roller bearings is carried out at intervals of twelve months, and care is taken that only a fixed amount of grease (1¼ oz) is inserted using a special pump to ensure adequate lubrication up to the next greasing period while avoiding troubles due to over-greasing. It is expected that the time will come when grease packed roller type bearings will be sealed from overhaul to overhaul, that is for a period of four or five years, and tests have shown this to be possible. It is a factor of some importance in bearing life that the London Transport railway system works on the fourth rail principle. This avoids trouble due to current passing through the bearings and obviates the necessity for providing special diverting brush gear on axles.

Commutators are examined when trains are in running sheds for their normal four or six weekly equipment inspection. From ¼ to 1 in. wear is usually allowed on brushes, and on a modern machine a life of about 18 months is obtained. If any general faults are found with the motor on inspection, it is returned for repair by specialists at a central point. For warning of the onset of any trouble, motors are regularly given an insulation test, in common with all other components of the power circuit. The lower limit accepted is 2 megohms, but it is rare for so low a reading to be due to traction motor insulation.

Overhaul

Periodically, motors come into the overhaul shop. Their life between overhauls usually corresponds with vehicle life, but care is taken by means of a motor history sheet that unnecessary routine work is avoided. Motors which come in before their time because the coach they drive is due for attention are removed and used when replacements are necessary, to avoid prolonging their overhaul period too much.

The first operation necessary with a traction motor is to clean it outside so that it can be handled without undue contamination from road dirt. Different methods are available. Steam cleaning, where used, should be followed by a drying process. Chemical methods may be used such as the seemingly extreme approach of dipping the whole motor in a trichlorethylene chamber. However, although many chemical cleaners do not damage the electrical insulation and are easily dried out, the total immersion of traction motors in a liquid or gaseous mixture has not found much favour. At the Acton Works of London Transport, cleaning is usually performed by hand. This has the advantage of dealing with any dust from cast iron brake drums which may have adhered magnetically to the motor casing.

Trouble with the brush gear revealed at overhauls usually results from the breakdown of insulation of supports, excessive wear on brush boxes, or short brushes; the last of these is, of course, a function of maintenance and should not occur. Insulators require critical examination and test before re-use, and it is necessary to provide gauges for checking the wear of brush boxes. Because most serious troubles causing failures on brush holders arise from lack of rigidity, the worst trouble can be eliminated only at the design stage, by ensuring that fixings and supports are free from vibration. The brush holders tend to accumulate a considerable amount of dirt composed largely of carbon and copper dust, and resort is had to shot blasting as an economical and effective method of cleaning.

Brush pressure on the commutator is important in traction motors as in other machines, maladjustment causing excessive wear of commutator, brush or both. On traction motors, brush pressures need to be in excess of those used for stationary machines, a pressure of about 5 lb/sq in. being used on multiple unit trains running at relatively high speeds.

For blowing out motors, hooded positions are provided in the overhaul shops where blowing with compressed air is associated with vacuum extraction and discharge via a dust settling chamber. This allows armatures and motor boxes to be handled at an appropriate position without inconvenience to other staff due to flying dirt.

Roller bearings, after removal from the motor are automatically washed in paraffin or white spirit. The cleaning fluid is fed by force into the rotating bearing, and subsequently filtered and re-used. After bearings have been washed, an air jet is passed through them to dry them before handling; this is a precaution against dermatitis. After cleaning, bearings are held in special boxes to maintain their state, as this is considered to have an influence on subsequent life. No attempt is made to repair bearings. This was necessary during the war, when races were built up by nickel deposition and oversize rollers fitted where excessive wear had occurred, but the process was found to be expensive.

Armature Reconditioning

The first attention given to the motor armature after cleaning is to the banding. This is renewed, if there is any doubt about its condition. A repaint with an insulating enamel is also required, some engineers preferring vacuum impregnation. The practice at Acton is to ensure that all external crevices are stopped up with insulating putty, and then to paint the whole armature with insulating enamel, and bake it for a period in an over at 110° C without impregnation.

At overhauls, commutators are skimmed. Normally a high speed tool gives satisfactory results, but where commutation has been found critical, some improvement may be obtained by using a diamond tool to produce an exceptionally good finish. Care is taken to remove the minimum possible amount of copper; a cut of 0·01 in. is usually found sufficient after 200,000 miles service. It is, however, essential to ensure that all bars are actually cleaned up. Before the commutator is turned, the edges of each section are bevelled, and slotting is then carried out. The mica is taken down at least 3/32 in. to allow for a possible 300,000 miles service without further attention to the commutator. It is considered desirable to introduce an exhaust plant for use with this work to keep the operator from inhaling mica dust. Cleaning out of the slots after the commutator has been turned is best done with a hand tool.

Tests for overhauled armatures include an h.v. insulation test using a.c. at a voltage at least double that of the normal d.c. supply. A bar-to-bar "drop" test to ensure that joints and coils are in satisfactory condition is also advisable.

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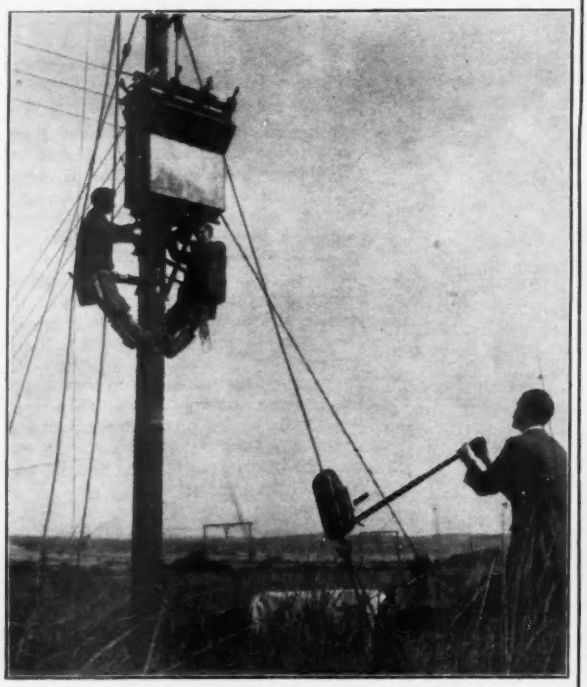

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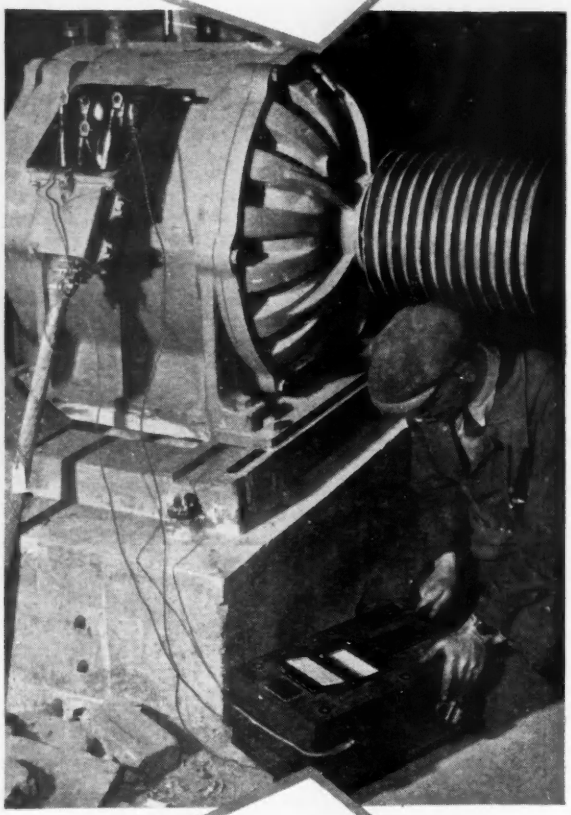

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Repairs

In spite of all the care taken in maintenance and overhaul, from time to time it is necessary to repair motors. Most motor failures occur in the armature, and a whole range of primary causes may eventually show up as an insulation breakdown in the armature slots. The main electrical repair work, then, consists of rewinding, and it is the practice in London Transport to carry this out with internal resources. It is argued that if the control of failures is to remain in the hands of the operator, he must carry out his own rewinding. In addition, it is felt that as the manufacture of armature bars is an essential part of the process this should be undertaken by the maintenance section. Depending on the price of copper, it is not usually found worth while saving old bars for reinsulation. Modern types of traction motors, used by London Transport have a simple wave winding with two layers of five bars in each slot, the bars being of evolute form. For the insulation of armature bars after the copper has been formed to shape, glass and silicone insulations now provide a better alternative to the Class B materials formerly available, albeit one that is more expensive. Standard practice is to provide as much bar-to-slot insulation as possible, if necessary at the expense of insulation between conductors. Frequent pressing at all stages of insulation receives close attention, but hot presses have not been found necessary for either shellac or silicone insulations, providing heating in an oven can be carried out between pressings.

When the bars have been placed in the armature slots a high voltage test is applied, 2,500 V for one minute being usual for 600 V motors. To ensure that the bars are down in the slot, as tight as possible, steel wedges running the whole length of the armature are pulled down by banding until there is no possibility of further movement. After this banding has been removed the final banding is applied. It is not considered necessary to provide tension measuring devices for use in this connection. After banding, the bars are soldered to the commutator risers. Finally, the armature is baked in an oven for 24 hours.

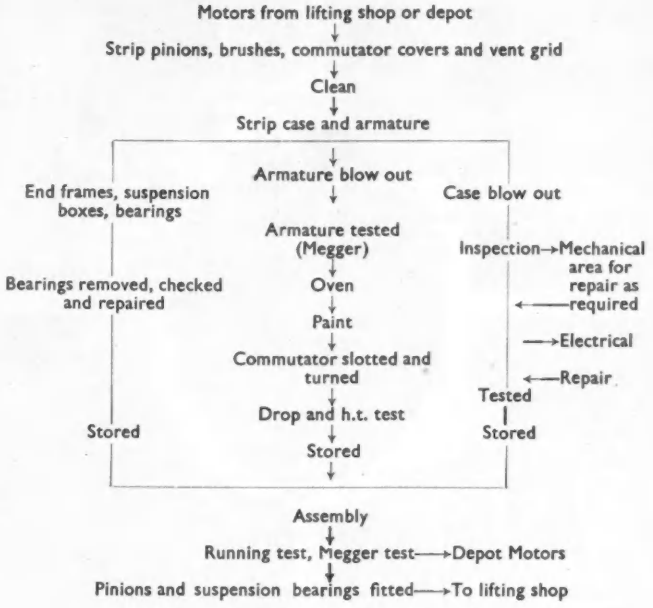
Commutator insulation failures are rare, but repairs are often necessary as a result of bad burning of bars following armature faults. It is the practice always to fit new insulating vee rings when commutators are dismantled. After an armature is rewound, the commutator bolts are tightened before and after the stoving of the armature.

Field Failures

Failure of the motor case and field windings is less frequent than with the armature. Insulation failures usually occur in this part of the machine because internal short-circuiting of coils has caused overheating which breaks down the external insulation.

Coils are wound on a start-and-stop slow speed winder with flat copper strip, insulation being placed between turns and layers as required and tightly secured. Completed coils are dipped in grey insulating paint and then baked. After this external sides are covered with mica-shellac insulation ironed into place, and an asbestos cloth covering is taped on. Further baking, pressing, and external taping follows. Silicone insulations can be used for field coils as well as for armature bars, and it is understood that this has been done in America as a means of uprating the power output of existing motors.

Brush holders are provided with detachable front plates which can be cleaned up to eliminate wear, or renewed if necessary. The box can be built up by brazing and machined back to size. It is found that when brushes with pigtails are used rather than plain blocks relying on current transfer from contact hammers at the end of the springs, there is less brush box wear, which seems to indicate that some brush box wear is associated with current transfer.



Flow diagram of normal overhaul procedure at Acton works

Mechanical Problems

In this summary of Mr Bruce's paper, attention has been focused mainly on the electrical maintenance and repair features, with mechanical work mentioned only when it directly affects the motor. In the original paper, there is extensive attention to the mechanical problems involved, and in particular to those connected with the gearing which forms an integral part of the type of traction motor dealt with.

Belts and Static

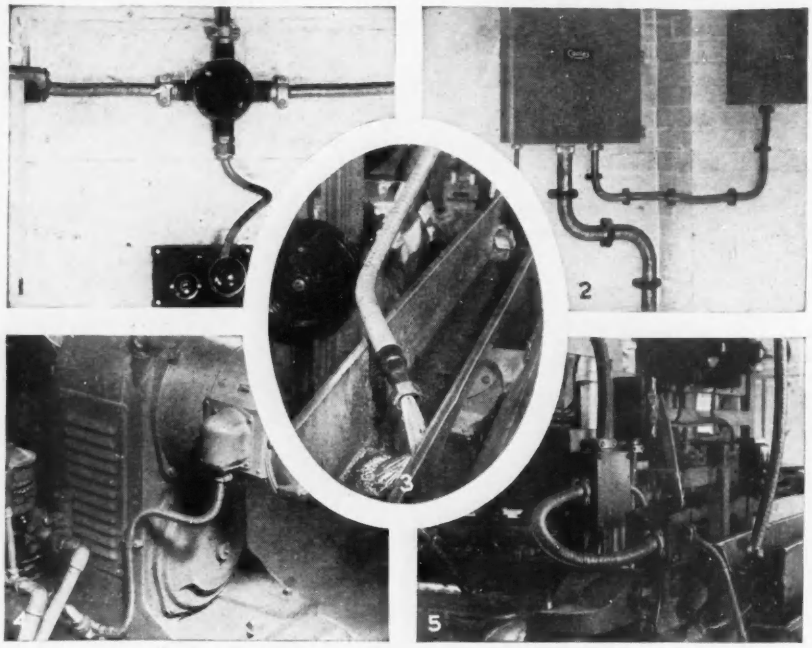
THIS is a rare problem but most fitters will meet it sooner or later. Needless to say the machine operator may be somewhat disturbed to see sparks about ¼ in. jumping from the belt to the machine frame and the maintenance man has to do something about it. The old dodge of a short piece of dangling chain or a row of close discharge points can be used, but a better method is to purchase, if possible, an anti-static belt made to rectify this problem.

Leather Belts

While still dealing with belts, the small leather belt so commonly used on sewing machines, must not be forgotten. Many small mechanisms use them and if the joint is carefully made they will convey a considerable power. When joining, the cut ends should be lightly hammered on their natural surface and a small hole drilled to take the C clip. These clips are slightly too long on the ends if the belt is to pass over a very small pulley and they will require shortening and carefully closing with a pair of pliers.

Cotton Belts

Very small flat endless cotton belts can present a problem if a replacement is not readily available but they can be made quite easily by stitching a length of suitable cotton tape into a circle on a sewing machine, feeding the tape in until a suitable thickness is obtained and continuing the sewing in parallel lines until a compact endless belt is obtained.—*K. W.*



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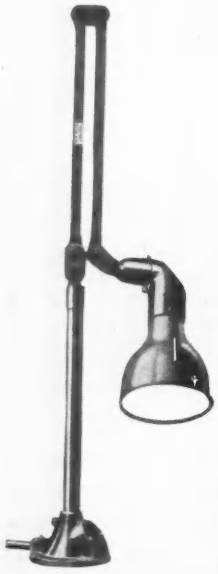

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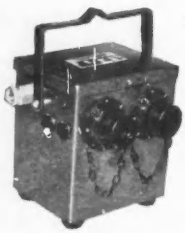

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Brushes and Commutators for Small Electric Machines

DATA SHEET 11

THE fitter is well advised to remember that commutation is a very involved process and he should, therefore, when replacing brushes, adhere to the maker's recommendations, assuming the maker is known and in general to avoid experimenting in this sphere unless it is absolutely necessary.

Fitting New Brushes

These must be:

(1) The correct size.
(2) The correct grade.
(3) With the correct position, length and size of flex tail if fitted and:
(4) If fitted with integral spring, the spring and cap must also be of the correct dimensions.

With regard to the size of the brush: since some are measured in millimeters and others in inches it is quite possible to have two very similar brushes which only differ by a fraction of an inch and, moreover, a correct brush inserted in a worn box may give the impression that the wrong size has been chosen.

The desirable limits of fit in a brush box are quite small; in practice it is usual to allow about ·004 in. on either side but this may be modified to suit:

(*a*) the construction of the box.
(*b*) the limits of machining.
(*c*) the expansion of the brush.
(*d*) the quality of the machine.

It is not advisable to have too close a fit in a box because a small accumulation of dust may soon prevent movement and a sticking brush quickly leads to trouble.

Items (3) and (4) can be easily checked, but the question of grade must be carefully considered. From one maker alone an enormous variety of grades is available. No difficulty should be found where new brushes of identical manufacture are fitted since the grade is usually marked in code. Difficulties will be met when changing from one maker to another or when dealing with articles of foreign manufacture. It is often useful, as a rough check, to draw lines on white paper with the edge of brushes and compare the marks made.

Bedding Brushes

This is usually an essential operation and a most unpleasant one. The larger machines present no particular difficulty and a strip of abrasive material can be inserted and drawn under the brush in the direction of rotation. (Glass paper is not very suitable and "wet and dry" will give much better results). On very small machines, particularly f.h.p. motors and portable tools, it is impossible to carry out the normal procedure; many such motors have blind commutator end-housings with only small ventilating holes. Commutators in these machines can be reached in two ways.

(1) By grinding down the end of a comm stick.
(2) By inserting a small piece of comm stone in the end of a small wood holder.

Take care that the angle of the comm stick is as in Fig. 1, otherwise the thin material may break off and possibly foul the armature.

Alternatively the brush can be bedded by inspection and filing or grinding to shape. Always leave the middle slightly hollow to ensure that the edges make good contact (Fig. 2). Brushes will then bed themselves in more quickly. The brushes must always be inserted in the same position when fitting.

In all cases, after bedding, blow out the dust and move the brushes in the boxes to make sure they are still free.

In machines with a number of brushes, the fitting of a completely new set may not give such good results until they have settled down for some time.

It will also be found that some f.h.p. machines both a.c. and d.c. will run quite well with very little attention, while others will spark violently until the brushes have been well bedded.

Spring Tension

This is of the utmost importance. There are many methods of applying spring pressure but they can be divided into three types:

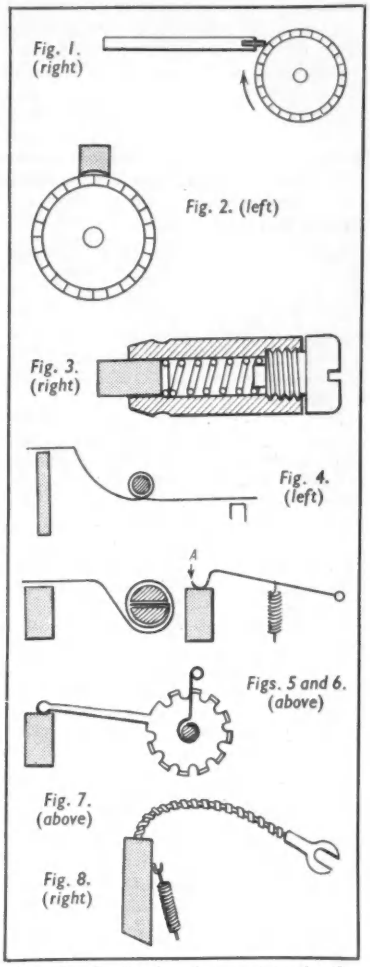
(1) Leaf or "clock" spring.
(2) Wire bow.
(3) Wire coiled spring, compression or extension.

Failure may be due to:

(1) Fatigue.
(2) Corrosion.
(3) Lost temper (where stray current has flowed via the spring).
(4) Spring fouling adjacent part.
(5) Spring becoming adrift.

Spring pressure which varies from 2 to 7 lb/sq in. may be applied to the brush in the following ways:

(1) Cartridge type of brush tunnel (Fig. 3). Take care that the spring does not jam in the tunnel.
(2) The wire loop (Fig. 4) found in some repulsion-induction motors and very small machines. Here the wire may cut through the brush and so reduce the pressure.
(3) The clock spring type (Fig. 5). These springs have to be strained back somewhat to insert the brushes and may, therefore, become gradually stretched and weaker. If the free end is too short, it may cut into the brush and prevent movement. It is usual to have flex tails on the brushes in this method and the tail must not foul the spring. Very small machines may not have a brush tail, consequently some current will pass through the spring itself.
(4) The lever type with extension spring (Fig. 6). Here the lever may become bent, fail to pass through the slot provided for it or the tip (A) may wedge in the brush box when the brush becomes worn.
(5) The coiled wire spring and cock's comb (Fig. 7). These are very liable to become bent, the spring to slip out of the hooks if the spring end has been strained and the pivot to jam by dust, etc.
(6) Direct pull on brush by extension spring (Fig. 8).



Figs. 1 to 8. Brush and commutator details mentioned in text

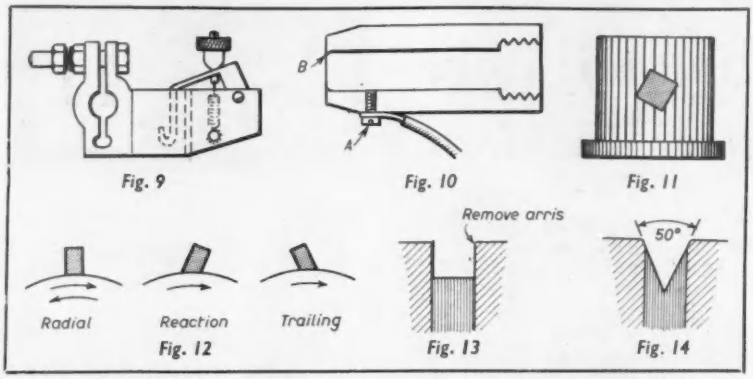


Fig. 9 Fig. 10 Fig. 11 Fig. 12 Fig. 13 Fig. 14

Figs. 9 to 14. Brush gear and commutator details mentioned in accompanying text

Brush Boxes

(1) The box type brush holder (Fig. 9). Many modern machines incorporate proprietary articles, which are usually of sound design and trouble free. (Smaller machines, however, often have the brush boxes of pressed strip and these are liable to distortion—usually through maltreatment.)

Even in small machines it is quite common to find groups of individual boxes mounted on an arm which in turn is either fixed to a movable ring or directly to the motor carcase. Therefore maintenance must include inspection of the brush gear generally. This will include checks for:

(*a*) Insulation and cleanliness of the brush support.
(*b*) Looseness of the rigging.
(*c*) Axial accuracy.
(*d*) The condition of any jumpers connecting sets of brushes.
(*e*) Fouling of the brush gear by the field or armature/rotor connections.
(*f*) The earth connection and/or the shorting jumpers between sets of brushes (in repulsion-type motors only).
(*g*) The earth return, mainly in small low voltage generators where one or two sets of main brushes are bolted directly to the frame.
(*h*) Freedom of movement when the brush position can be altered, either manually or automatically, e.g., in variable speed motors.
(*i*) The condition of the flexible feeder leads to movable brush gear.
(*j*) Clearance between brush gear and windings or armature risers. (N.B. Excessive float may "take up" a normal safe clearance.)
(*k*) Slackness in any terminals or fixing bolts.
(*l*) Fouling of brush leads or jumpers between 2 or more sets of brushes, e.g. in automatic lighting plants there can be 3 sets of brushes on one brush rigging.

(2) The cartridge type (Fig. 10). Although very simple they can give trouble. The rectangular section may become worn after long service and a new brush may tend to lock. The screw at A, sometime used for the field connection, may foul the brush if the terminal thickness has become altered. They can become loose and rotate in their housing so causing the brush to bed-in skew (Fig. 11). In becoming loose they may rub the commutator and burr the end at B (Fig. 10) so preventing a brush from reaching the commutator. (Rotation is usually due to too much force being used in fitting the brush cap.)

(3) Die cast boxes similar to Fig. 9. These are very subject to corrosion in certain atmospheres.

(4) There are 3 normal types of brush positions, shown in Fig. 12 with the direction of rotation marked.

Flexible Tail

(1) Be sure the tail is long enough.

(2) The diameter is important. It is quite possible to exchange one brush for another similar, but with a smaller tail, and it may heat up and corrode under heavy currents.

(3) Fracture of tail or disconnection at the terminal may cause heat and soon ruin a good box.

(4) The tail must not foul any adjacent part. A very obvious statement but difficult to achieve in, for example, very compact traction motors used on large milk floats. In such cases it is usual to insulate the brush tail with sleeving.

(5) For corrosive atmospheres, tinned flex leads insulated with cotton sleeving can be used.

Commutator

(1) It must be solid. Commutators are frequently found with slightly loose bars, particularly in small armatures, usually the result of armature or brush trouble. Since most small commutators are riveted together little can be done but larger bolted commutators should always be checked for tightness while warm.

(2) It must not be loose on the shaft. This fault is by no means uncommon and usually shows itself by the broken wires behind the risers.

(3) The surface must be good. It is obviously a waste of time to fit new brushes to a bad commutator. The word "good" requires qualification. Many old time fitters will swear by a certain commutator colour and texture and always hope and expect to obtain such conditions. There is no single optimum or desirable condition, and the appearance of a commutator in good working order will vary greatly in different machines and even in otherwise identical machines. Hence the d.c. machine may tend to form a mature skin on its surface with the so-called characteristic colour but, to take an extreme example, some a.c. repulsion-start induction-run machines will always have a black and apparently burnt and roughened commutator surface.

(4) The commutator must be concentric with the journal. Any eccentricity of the commutator can be felt by the movement of the brushes, indeed an eccentricity of a few thou can be seen as the brush rides up and down, particularly so when the machine is slowing down. Similar symptoms are exhibited with a badly worn bearing, consequently the condition of the bearing is of prime importance. A commutator may become out of centre as a result of expansion and contraction, especially in the case of large commutators during the process of seasoning. Small commutators do not suffer to such an extent with the exception of some moulded commutators and those on low voltage machines using fibre cones instead of mica. In these commutators single bars are liable to rise slightly.

(5) The brush track must not overhang the commutator edge nor foul the risers.

(6) The armature (or rotor) must be balanced preferably dynamically. Out of balance can cause brush bounce and bad commutation.

(7) The surface must be free from oil or grease. Commutators can be washed in petrol or paraffin but they should not be immersed in the liquid. Cleaning should always precede grinding. (On rare occasions a *minute* amount of lubricant may be advantageous.)

Undercutting

This point has been discussed many times and to review the position:

(1) If originally undercut (by makers) always undercut.
(2) Undercutting must be adequate and carefully done; a mere scratch along the mica is a prospective danger (see below).
(3) If the commutator was not undercut take care that the micas are not high. Here again, if a commutator has only to be polished, glass paper will not remove a few tenths of high mica. Use "wet and dry."
(4) Most commutators are undercut. Fig. 13 shows the normal undercutting in England and Fig. 14 an American method.
(5) Always examine a commutator for
(*a*) Isolated high mica in flush commutators.
(*b*) Isolated micas not properly undercut.
Either of these can lead to armature failure and:
(6) Since most small armatures are machine undercut, watch out for any skew bars. These will leave dangerous fins of mica.

(*To be continued*)

EARTH-LEAKAGE RECORDING

Notes on Factory Applications and Installations

RECORDING earth-leakage currents in a factory installation is not only a safety measure; it is also a considerable aid to efficient maintenance. Its advantages have been analysed before in the ELECTRICAL TIMES,[1] but they will bear repetition here. Since the majority of faults on a factory system are faults to earth, the earth-leakage chart will show them against time of occurrence. If faults are in the incipient stage, as yet of too high a resistance to operate overcurrent protective gear, then the chart may give the maintenance engineer a first clue as to the circuit involved for he can work from his knowledge of the time of operation and the frequency of starting of the machines under his charge, and so interpret the line drawn on the chart.

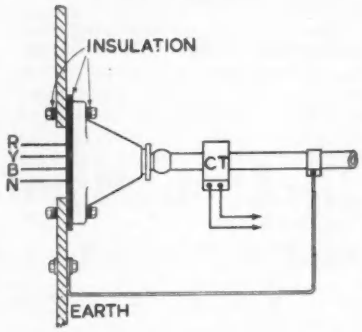
This, of course, is after the earth leakage has been reduced to a low level. When recorders are first installed, it is not unknown for leakages of 10 or 20 amps to be revealed. The current has presumably been flowing for months or years before the recorder was installed, but has been quite unsuspected by the engineer concerned. It may even be necessary to disconnect the recorder until this initial accumulation of faults has been cleared: but from that time onwards, the earth leakage recorder becomes one of the plant electrical engineer's most valuable aids to diagnosis.

Recorders and Indicators

The different facilities offered by a simple earth-leakage indicator, and by the more complicated recorder deserve consideration. For a continuous fault there is little to choose between the two instruments, and this type of fault can exist for long periods where there is no attempt at all at earth-leakage measurement. For instance, it may be caused by tracking across fittings or across insulating clearances where the factory atmosphere is dusty or damp. Any type of earth-leakage measuring instrument can lead to the detection and eventual elimination of such faults, and the aggregate earth leakage—even with a factory having a maximum demand of some megawatts—can be reduced to a fraction of an ampere. That is where the plant engineer will want to keep it: and at that stage the advantages of the recorder over the indicator begin to show.

To appreciate the reason for this, the type of fault likely to be encountered may be considered. Gradual build-up of dust across insulating surfaces, already mentioned, is shown by a gradual increase in leakage, and the need for cleaning is made apparent. Faults on particular circuits may be traced if the plant engineer knows his factory and its routine, by noting the time that increases in leakage appear, and relating this to the switching-in of certain circuits or items of apparatus. Unless the substation is attended, and special attention is being given to eliminating earths, this is not possible with an indicating instrument. The same question of time applies when portable tools are in use.

Another method of diagnosing faults



Insulation of cable box in connection with earth leakage c.t. installation

shown on an earth-leakage recorder is to trip out momentarily in turn the circuit-breakers supplying circuits from the substation concerned.

This has been used successfully at one large factory where conditions were, in fact, so bad originally that the recorder when first installed had to be switched out of circuit while the larger faults were traced. This experience is worth considering in terms of cost. The range of the usual recorder is 0 to 10 or 20 amps. Supposing the total leakage of the factory was 10 amps, and that the circuits were alive at 250 V to earth for 12 hours a day, then over a year, the cost of energy wasted in electricity estimated at 1d. per unit was about £46. Such considerations make the cost of installing an earth-leakage recorder seem reasonable enough, merely on the basis of direct savings, but the main support for such a step really comes from the improvement in the condition of an installation that it makes possible.

C.T. Positioning

The general form of the earth-leakage recorder involves the installation of a current transformer in the neutral to earth connection of the factory supply. This apparently simple step may occasion some snags, and there has been recently a discussion of these by H.M. Senior Electrical Inspector of Factories[2] which will repay attention if the installation of recorders is being considered.

The first case to be considered is an example of "too good to be true." For two years an earth leakage recorder at an engineering works gave no indication at all. Since faults show, even if they are cleared by the operation of overcurrent trips, this seemed suspicious. The reason was found in the positioning of the current transformer associated with the recorder. The works generated its own power, and the star point of the alternator was connected to an earth bar, which in turn was connected to the earth electrode system. All the factory earth-continuity conductors, mainly in the form of cable sheathing, were also bonded back to the earth bar. The current transformer for the recorder was connected to the earth lead—but between the earth bar and the earth electrodes. With metalclad gear, earth-faults caused no current to flow in this part of the earth circuit, for they completed their path through cable sheath, earth bar, and connection from earth bar to star point. It is in this last position—between earth bar and star point — that the current transformer should have been connected. The same requirement, of course, applies when a public supply is taken, and is transformed down on the factory premises.

In another installation, a somewhat similar mistake was made. The supply in this case was taken from a supply authority substation on the premises, but the neutral to earth connection of the transformer was not available. Instead, the current transformer was arranged to measure only the current in the neutral core of the four-wire supply. This, however, gave the out-of-balance current of the supply as a whole. Current passing to earth through faults in the factory returned via the general factory earth to the neutral point earth connection of the supply transformer, having no direct effect on the earth leakage recorder. In such circumstances, the best solution is a current transformer connected to measure the effective residual current from all four cores. This is the earth-leakage current, but some care is again required. If the measurement of current is to be successful, the cable sealing end should be insulated from the earthed metal of the intake switchgear, and a bond arranged to bypass the c.t. position, as shown in the diagram.

Excessive Ratio

As a final example of a mistaken installation, the story may be repeated of a wartime factory, in which once again, the neutral to earth connection of the supply authority's transformer was not available. However, the incoming main switch under factory control was provided with an earth-leakage relay, operated by summating the output of

four current transformers on the three phases and the neutral. The connection to the earth-leakage relay was broken, and a transformer connected whose secondary fed the earth-leakage recorder. No leakage was recorded for eight years and again, the reason is not far to seek. For the earth-leakage protection, current transformers having a ratio 3,000/5 were provided. The earth-leakage recorder, on the other hand, was concerned as is usual with currents up to about 25 A. Needless to say, the protection c.t.s were quite insensitive to such relatively small currents.

Of course, these difficulties are illustrative only of the care needed to ensure that the installation of the transformer of an earth-leakage recorder is correctly carried out; it is worth while obtaining advice on this point if there is any doubt. Once installed, there is little specially to go wrong with the earth-leakage recorder, and attention may be turned rather to the technique needed to obtain the best value from the instrument, which has been discussed already.

For d.c. circuits, it is common practice to connect two or more lamps in series across the poles of the system to indicate earth faults. A recent development noted by the Factory Inspectors[2] is the use of an inductor with a core of the ring type placed over the connections of each outgoing circuit, and provided with an alternating current supply to a secondary winding on the core. The value of the earth-leakage current causes the a.c. to vary and can be read on an ammeter in the secondary circuit. Thus the circuit subject to the leakage is indicated, and its value shown.

Multiple-Earthed Neutral

This article has been largely concerned with the troubles that may be experienced in ensuring that an earth-leakage recorder tells the true story. It is as well to finish on another note of warning: faulty decisions on the position of installation are not the only possible source of error. An installation has been described in which the recorder was fed through a core balance transformer. When an artificial earth fault was simulated, there was no indication at all on the recorder. Investigation revealed the trouble: the neutral on the factory premises was inadvertently earthed, and its resistance was much lower than the distant substation earth-plate. Consequently, the earth-fault current was returning to the transformer star-point though the supply neutral, and the current in the four-core cable was completely balanced.

REFERENCES

1. "Check Leakage Currents," ELECTRICAL TIMES, Vol. 118, 17 Aug., 1950, 254-256.

2. Electrical Accidents and their Causes, 1952. Factory Department Form 929, published by H.M.S.O., price 3s.

Time Check on Maintenance

Elapsed Time Indicator Logs Running Hours Between Overhauls

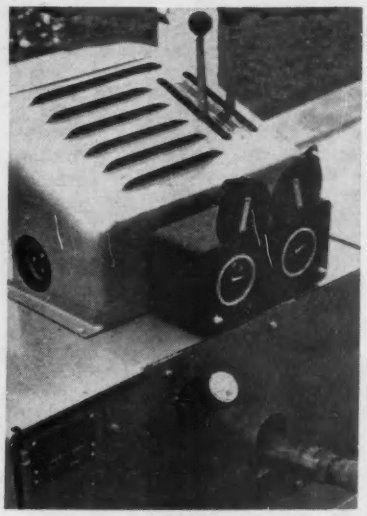
MAINTENANCE plans often provide for attention to be given to a machine every so many weeks, and this arrangement works well enough when there is a regular routine of use. But it is not time alone that brings wear to a machine and its components; it is rather the period of running as distinct from standstill. It is this idea that is behind the application of lapsed time indicators, one of which is illustrated in the accompanying photograph.

Indicator Principle

The basic principle of the elapsed time indicator is simple enough. A clock motion is provided that begins to operate when the machine starts to run, stops when it stops, and restarts automatically to repeat the cycle as often as required. In the model illustrated, which is a product of Case and Phillip Ltd, Mark Rd, Adeyfield, Hemel Hempstead, Herts, two dials are provided to read minutes by the pointer and hours on a cyclometer recorder. Other arrangements are, however, available. In the case of electric motor driven equipment it is usually possible to connect the indicator into an appropriate motor control circuit. In other cases, where a convenient electricity supply source is not readily available, as will happen on rare occasions, it is possible to work the indicator from a low voltage battery supply: the usual operating voltage is 6 or 12. As an example of flexibility of operation, the measurement of vehicle running hours may be considered. With an i.c. engined vehicle, the indicator may be connected so that it is switched on and off by movement of the hand brake, while the control circuit is switched on and off with the engine ignition. This will distinguish between vehicle running hours and gross engine running time.

Operation of the indicator is by means of a balance wheel which is made to operate by a permanent magnet armature swinging in the gap in the soft-iron core of a coil. The electro magnet is energised intermittently by means of a sliding contact make and break device operated from the balance wheel, and controlling the low voltage supply circuit of the instrument.

The self-starting control circuit is so arranged that when the supply is switched on, a solenoid plunger gives the first kick to the armature, and so makes the make and break device, and energises the electro magnet. In this way the balance wheel is set oscillating. On switching off, the balance wheel automatically comes to rest.



Twin elapsed time recorders here indicate travelling time and lift operating time on an electric fork lift truck

One of the design features which has received special attention is the jewelled bearings. These are of the Incabloc shock-proof type, and are believed to be the largest of this design made. They serve to protect the movement against damage due to vibration, which may obviously be quite heavy in some applications, and which has caused trouble in some similar instruments in the past.

It is understood that the design of the instrument is the subject of patent specifications.

First Return

The accent in this description has been placed on maintenance considerations, but there is another quality of interest to the plant engineer which the elapsed time indicator can help measure. This is the utilisation factor of machines, which may be of importance when planning decisions have to be taken in relation to the rearrangement of machine loading or vehicle utilisation. Total working hours are relatively easily recorded, either by time recording arrangements or by staff observation, and the elapsed time indicator can provide the other component required, the time actually spent in doing some specified job. This may of course require more than one recorder. An example is given by the use of two indicators on a fork lift truck. One of them is connected to indicate the time spent travelling, while the other keeps a tally of the periods for which the hydraulic lift mechanism is in use.

QUESTIONS IN PARLIAMENT

Sub-Area Organisations

THE Minister of Fuel and Power said last week he had issued no directions relating to the disbandment of sub-area organisations in the electricity supply system. In the same way he told Mr A. J. Irvine that he had not issued general directions that large-scale reorganisations within the electricity supply system shall not take effect without prior consultation. Mr Irvine asked whether the disbanding of sub-area organisation in London was likely to effect working conditions, resulting in redundancy. He queried whether or not that was a matter for direction. He went on to say that there were workers in the industry, whose political affiliations were not suspect and who were entitled to be heard, who were of the opinion that the joint consultation which had taken place had consisted merely of the handing out of prior information. The Minister said he understood the London Board was experimenting with certain reorganisation in order to reduce administrative costs. All were in favour of joint consultation but the actual enforcement of it and the questions of administrative economy were matters for the Boards themselves.

Annual Reports

AFTER a debate last week, the House of Commons formally "took note of" the latest reports of the Gas and Electricity industries. In opening the debate, the Minister of Fuel and Power emphasised his view that the nationalised fuel boards should be adventuresome and enterprising, and promised to give full weight to this opinion in his relation with the boards and in appointing their members. He said that he realised that not every venture could be successful; there were bound to be mistakes. In such cases, he said, when decisions had been taken on sound and enterprising lines, he would consider it his duty to defend the boards. He paid tribute to the practical way in which he found the engineers of the B.E.A. tackling the problems of nuclear engineering.

Mr Alfred Robens, who opened for the Opposition, regretted that M.P.s did not have time to examine the reports in detail; he noted, however, that there would soon be select committees of the House to examine them. He suggested that action should be taken to interest the community at large in the reports. In particular, he thought that the area boards should convene local government conferences to discuss their reports. He criticised the time which, it was estimated, it would take for a nuclear power station to be feeding into the Grid (he reckoned this as ten years), and later, he alleged that according to their accounts, there was reckless competition between the two industries with too much spent on publicity and not enough on research. He called in particular for an amalgamation of showrooms, and for an overall consumers' fuel advisory service.

Succeeding speakers ranged widely, many of their points concerning specific area board problems. There was advocacy of small diesel generating sets, and of extended attention to district heating schemes; there was a call for extended use by the B.E.A. of its right to manufacture plant and to compete for contracting business; and there were demands for the B.E.A. to state its pricing policy. At the end of this, Mr A. M. F. Palmer rose as the last Opposition speaker in the debate. He supported the right of the nationalised fuel industries to advertise, but called for them to set an example in their advertising, to be accurate, and to avoid damning their competitor's product. Turning to the Herbert Committee, which is investigating the organisation and working of the B.E.A., he said that it should consider promotion policy in the supply industry, because there was some question as to whether the present methods were successful in bringing the ablest men to the top.

Of joint consultation in the industry, Mr Palmer said that it was a machine without a true soul. This was because the electricity boards did not trust their employees sufficiently to talk with them on things that really matter. A final point he made was, that he was doubtful if the price of electricity, particularly for peak load units, was yet high enough.

Mr L. W. Joynson-Hicks, Parliamentary Secretary to the Ministry of Fuel and Power replied to the debate. He answered many of the questions that had arisen, and assured Mr Robens that there would be a large scale supply of atom-based electricity at the end of the ten years mentioned. On research, he emphasised that much of the B.E.A.'s spending in this category was in respect of capital expenditure, not shown separately as research in the report. He agreed that it would be admirable if the B.E.A. in its next report, published some remarks on its pricing policy.

Vehicle Headlights

THERE was some discussion last week on the question of dazzle caused by headlights on the road. Mr Shepherd asked what action was being taken and whether as an interim measure, the yellow light could be adopted. The Minister of Transport said action to check dazzle depended largely on standardisation of lighting power and correctness of aim. Preliminary work had been carried out but new regulations could not be made until facilities for enforcement and testing could be provided. Attempts were being made also to secure international agreement. As regards the view that yellow lights reduced dazzle, the weight of scientific evidence was against it. Replying to Mr G. R. Strauss, the Minister said consideration was being given to the distracting effect of "blinking, twinkling trafficators."

TV in Sussex

THE B.B.C. now proposed to continue the Truleigh Hill booster station at Shoreham, Mr D. Gammans stated in a written answer last week. He said a change in frequency would be required involving small modification to viewers' sets and in some cases to their aerials.

Pedestrian Crossings

DURING a series of questions on pedestrian crossings, Mr C. I. Orr-Ewing asked whether more light could shine down on crossings. The Minister of Transport reminded him that the illumination of crossings was the responsibility of the local authorities. He hoped the authorities would note the suggestion.

Factory Inspectorate

THE promised adjournment debate on the factory inspectorate was introduced in the Commons last Friday by Dr B. Stross. His reasons for bringing up the subject were firstly the shortage of new entrants with suitable professional qualifications and technical experience, and secondly to ask if the situation could be remedied before it was too late. In his reply, Mr H. Watkinson said the difficulty was not so much recruitment as the technical ability and qualifications of those recruited. The factory dept. would like 50% of its members technically qualified, and the present figure was 36%. The outlook, he said, was not as alarming as had been painted, although sufficient personnel were not being recruited. He said that more technically-trained people would have to be recruited. He did not agree that the standard of the inspectorate was dropping; that was something that might come in the future if more people were not recruited. On pay, Mr Watkinson did no more than say Dr Stross was justified in pointing out that factory inspectors lagged behind, but said they must await the Royal Commission's report.

Religious and Political Opinions

ON Monday, the Minister of Fuel and Power was questioned about the practice of electricity boards in asking applicants for such jobs as meter reader their political and religious views: particular reference was made to the Midlands E.B. Replying, the Minister said that he agreed that such questions were liable to lead to misunderstanding, and he was taking steps to see that his views were fully understood by the boards. He did not think the practice was widespread. Interviewing was a managerial responsibility, and a general direction by the Minister was neither appropriate nor necessary.

COMPANY ACTIVITIES

ANOTHER excellent year has been achieved by Mr A. G. Clark, the chairman and the management of the Plessey group. Despite a 100% bonus and a new issue of three new shares for every five previously held, dividend is brought up to 20% on £500,000 of capital. The new capital gets a final payment of 10% only.

This compares with 30% paid last year on only £250,000 of capital. Trading profit is up from £819,519 to £1,059,206. At 60s. the yield is 3½% and the company has yet to feel the real effects of the withdrawal of H.P. restrictions. Net earnings were equal to 87·4%. Ex-E.P.L., they would be nearer 108%. So that there is a cover of over 4½ times at the moment which would rise to nearly 5½ times when E.P.L. is no longer payable.

Group earnings of Electrical Apparatus Co. for the year to July 31 last, ex-E.P.L., are almost 105% and cover the 22½% Ordinary dividend over 4½ times. The trading profit rose from £193,000 to £316,000, the net figure being up from £74,000 to £130,000. Demand appears to be on the increase following the expansion of industries served and the general growth of mechanisation.

A little disappointing were the results of Joseph Lucas which makes electrical and other bits and pieces for the motor-car and aero trades. Dividend went up to 1s. 6d. a share against the equivalent of 1s. 1d. last year, while trading profits at £6·9 millions went against £6·2 millions The shares have come back from the highest this year of 49s. 3d. to 44s. at which they yield less than 3½%. With the industrial boom a little ragged at the moment it might be possible to get Lucas shares at a few shillings lower. Around 40s. they should be an excellent lock-up in view of the great activity which is taking place in the motor trade.

If the J. Lucas results appear a little disappointing, not so those of S. Smith and Sons (England) Ltd., in a similar line of business. Profits in that case jumped from £2,125,725 to £2,853,609. The comparison has been adjusted to incorporate the figures of the newly-acquired group, Kelvin and Hughes. Despite a 60% share bonus, dividend on the Ordinary is raised from 15 to 17½% and takes almost twice as much at £278,257. The results are commendable in view of the increased competition.

But from now onwards one must expect profit margins to be pared. Allowing for that, the increased dividend is extremely well covered at 4½ times if E.P.L. is taken out of the reckoning. At Friday's closing price of 14s. for the 4s. Ordinary shares the yield is satisfactory around 5%.—*From our City Correspondent.*

British Electric Resistance Co. Ltd.

The net profit, after taxation, for the year ended 31 July last is £15,736, compared with £14,056 a year ago. The final dividend is 17½% making a total distribution of 20% on the doubled capital. In the previous year the total was 25%.

B. and F. Carter Ltd.

For the year to 31 July last, the trading profit is £46,853 (*£45,628*). The dividend is 15% (*12½%*) plus a bonus of 5% (*same*).

T. Clarke and Co. Ltd.

An unfortunate slip occurred in our note last week on the rights issue being made by this concern. The 227,312 2s. shares are to be offered at 4s. each (not 40s.).

Dictograph Telephones Ltd.

After charging taxation, depreciation, etc., the consolidated profit for the year ended 31 Aug., last is £68,392 (*£62,367*). A final dividend of 10% again makes the total distribution 20%.

Electrical Apparatus Co. Ltd.

A substantial increase in profits for the year ended 31 July last is shown in the accounts. The group trading profit for the year is £316,462 compared with £193,355 a year ago. After charging depreciation, taxation, etc., the net profit is £130,487 (*£74,493*). Thus, the profit is even higher than was forecast in the preliminary announcement. Mr R. H. Barbour, the chairman, explains that the increase is mainly due to the auditors preferring to take into credit this year certain sales, not yet completed, of stocks remaining on the disposal of the a.c. meter business. Various special orders which had been the subject of long and expensive preparatory work came at the same time to the stage of full production. Two new bays have been added to the company's main factory. The directors hope to put forward proposals early next year for amalgamating the present two classes of Preference shares into one class.

Falk, Stadelmann and Co. Ltd.

The group profit for the year to 31 Mar. has increased by over £135,000 to a total of £536,809. After charging taxation, minority interest and retentions by subsidiaries, etc., the net profit amounts to £92,037 compared with £56,795 a year ago. There is a final dividend of 5% again making a total of 15%. The directors state that increases in sales were recorded throughout the business. Since the beginning of the current financial year further expansion has taken place.

Longmore Brothers Ltd.

Referring to the reduction in profits (noted in our 4 Nov. issue), Mr C. Longmore, the chairman, states that output of tubes was more than maintained, but owing to a continued reduced demand for bright steel the value of the total turnover was lower by some 18%. Profit margins were lower and the company had to meet a further wages award and increased freight and other charges.

Joseph Lucas (Industries)

After taxation, the consolidated surplus for the year to 31 July last is £1,451,498 (*£1,217,149*). The final Ordinary dividend is 1s. 3d. per £1 share.

Plessey Co. Ltd.

This concern reports a sharp increase in trading profits for the year ended 30 June last. After charging directors' emoluments, and depreciation, the trading profit is £1,059,206, compared with £819,519 for the previous year. When taxation and other charges are allowed, the balance available is £473,484 (*£327,036*). The final Ordinary dividend is 10% on the increased capital.

Scottish Cables (South Africa) Ltd.

Serious trading difficulties were encountered during the year ended 30 June last, Mr William Fraser, the chairman, states. But order books are now in a much healthier position than at the close of the year, particularly in regard to the heavier power distribution cables.

S. Smith and Sons (England) Ltd.

Group profit, before tax, for the year ended 31 July last, is £2,853,609 compared with £2,125,725 for the previous year. The final dividend is 12½%, making 17½% on capital increased by the three-in-five scrip issue last February. The previous year's dividend was 15% on the smaller capital.

Tube Investments Ltd.

Reporting on the activities of the Electrical Division during the year ended 31 July last, Sir Ivan A. R. Stedeford, the chairman, states that sales of Creda electric cookers and water heaters were more than doubled during the year. Competition in industrial electrical equipment has intensified but the volume of sales was maintained while the trade in plastic covered electric cables has justified plans for increasing productive capacity. The Mersey Cable Works, although not a member of the C.M.A., suffered from the industry's confusion following the Monopolies Commission report which has led to severe price cutting. The company has maintained its volume of sales, but the year's trading result was below any reasonable expectation, he states.

Dividends Declared

Johnson and Phillips Ltd. Interim of 7½% (*same*).

Solus, Teoranta. Final dividend 5%, plus bonus 2½%, again making a total of 12½%.

Telephone Manfg. Co. Interim 2½%.

COMMERCIAL INFORMATION

Contracts Open at Home . . .

Dates given are the final for receipt of tenders unless otherwise stated.

20 Nov.—Eire. Gt. Northern Railway Board requires supplies during 1955.—See 4 Nov. issue.

20 Nov.—Hamilton T.C. Electrical equipment for old people's home.—See 11 Nov. issue.

22 Nov.—Longbenton U.D.C. Sodium vapour street lighting units on concrete columns along A.1.—See 11 Nov. issue.

22 Nov.—Manchester T.C. Installation at Queen's Park Branch Library.—See 11 Nov. issue.

22 Nov.—Newport (I.o.W.) T.C. Group B lamps with concrete columns.—See 11 Nov. issue.

24 Nov.—Co. Down. Electrical services at Donaghadee intermediate school.—See 28 Oct. issue.

24 Nov.—Littlehampton U.D.C. Installation in 12 houses on Wickbourne estate.—See 21 Oct. issue.

25 Nov.—Co. Antrim. Electrical installation in proposed extension at Portglenone primary school. County Education Committee, Education Office, 475-7 Antrim Rd, Belfast. Deposit £3. 3s.

25 Nov.—Gosport T.C. Electrical work in proposed community centre for Bridgenary, Rowner and Woodcot. Borough Engineer and Surveyor, Town Hall. Deposit £1. 1s.

26 Nov.—Dublin T.C. Mercury vapour lamps for public lighting dept.—See 11 Nov. issue.

26 Nov.—Manchester T.C. Installations in dwellings on Langley Hillside estates and Heaton Park Rd.—Advertised in 11 Nov. issue.

26 Nov.—Manchester T.C. Electrical installation in 10 houses in Hermitage Rd, Crumpsall (Contract 213) and in 80 maisonnettes and flats at New Cross (Contract 215). Director of Housing, Town Hall.—Advertised in this issue.

26 Nov.—Manchester T.C. Electrical installation in 16 maisonnettes and flats in Cambridge St, Hulme. (Contract 194.) Director of Housing, Town Hall.—Advertised in this issue.

26 Nov.—Runcorn R.D.C. Group A mercury vapour or fluorescent lighting along trunk roads A.50 and A.49.—Advertised in 11 Nov. issue.

27 Nov.—Cornwall. Electrical installation in county secondary school at Wadebridge. Apply by above date to S. Gregson, County Architect, County Hall, Truro.

27 Nov.—Lanarkshire. Electrical installation in Platthorn R.C. primary/secondary school. Apply by above date to W. C. Brownlie, county clerk, Lanarkshire Hse, 191 Ingram St, Glasgow.

27 Nov.—Reigate T.C. Street lighting equipment along Guildford-Maidstone Rd.—Advertised in 11 Nov. issue.

29 Nov.—Barnsley T.C. Group A street lighting improvement schemes.—Advertised in 11 Nov. issue.

29 Nov.—Belper U.D.C. Wiring concrete columns and brackets in group A along A.6.—See 11 Nov. issue.

29 Nov.—Bletchley U.D.C. Concrete columns and 3-light fluorescent lighting units.—See 4 Nov. issue.

29 Nov.—West Lothian. Street lighting installation at Linlithgow Bridge.—See 11 Nov. issue.

29 Nov.—West Riding. Rewiring at Ripon Cathedral girls' and infants' school. County Architect, Bishopgarth, Westfield Rd, Wakefield.

29 Nov.—West Riding. Electrical installation in new assembly hall at Bretton Hall training college. County Architects, Bishopgarth, Westfield Rd, Wakefield. Deposit £2. 2s.

30 Nov.—Co. Down. Electrical installation in 247 houses at Bangor. N. Ireland Housing Trust, 12 Hope St, Belfast. Deposit 10s.

30 Nov.—Co. Meath. Supply and erection of two electrically operated pumping units with accessories for Duleek water supply. Secretary, Meath County Council. Deposit £5.

30 Nov.—Keynsham U.D.C. Electrical installation in 42 houses on Park West estate. Engineer and Surveyor, Council Offices. Deposit £2. 2s.

30 Nov.—Tottenham B.C. Lamps wanted in year from 1 Apr.—See 14 Oct. issue.

1 Dec.—Newcastle-on-Tyne. Lighting installation in two steam hopper barges for Tyne Improvement Commission. Secretary, J. K. McKendrick, Bewick St. Deposit £1. 1s.

1 Dec.—Willesden T.C. Supply and erection of concrete columns, lanterns, sodium lamps, etc., for group A lighting along about 3½ miles of North Circular Rd. Borough Engineer and Surveyor, Town Hall, Dyne Rd, Kilburn, N.W.6. Deposit £2. 2s.

2 Dec.—Forres T.C. Columns, brackets, lamps, etc., for group A lighting along A.46.—See 11 Nov. issue.

2 Dec.—Harwich T.C. Electrical installation in block of 12 flats in Cliff Rd, Dovercourt. Borough Architect, Town Hall. Deposit £2. 2s.

3 Dec.—Connah's Quay U.D.C. Supply and erection of 47 class A concrete columns and sodium lamps with auxiliary gear and wiring. Surveyor, Council Offices, High St. Deposit £2. 2s.—Advertised in this issue.

3 Dec.—Dublin T.C. Supply of 14,000 yds of flex for public lighting dept. Finance Dept., City Hall.

3 Dec.—Morley T.C. Supply and erection of 42 140 W sodium lighting units along trunk road A.650. Street Lighting Superintendent, Town Hall. Deposit 10s. 6d.—Advertised in this issue.

4 Dec.—Higham Ferrers T.C. Street lighting units along trunk road A.6.—See 11 Nov. issue.

6 Dec.—Slough T.C. Group "A" street lighting columns and lamps at London Rd.—Advertised in 11 Nov. issue.

7 Dec.—Herne Bay U.D.C. Electrical installation in 62 houses in Stanley Gdns. W. W. Smith, Engineer and Surveyor, Council Offices.

8 Dec.—Newcastle-on-Tyne T.C. Conversion from gas to electric lighting in total of 1,008 houses on St Anthony's estate, in Clarendon St, and at St. Lawrence Sq. City Architect, 18 Close Market.

10 Dec.—Ennerdale (Cumb.) R.D.C. Internal wiring of 206 houses at Castle Croft, Egremont. Engineer, Council Chambers, Cleator.

10 Dec.—Tiverton (Dev.) R.D.C. Mercury discharge lighting along Exeter-Leeds trunk road A.38.—Advertised in 11 Nov. issue.

13 Dec.—Manchester T.C. Overhead electric-driven cranes, etc., wiring, lighting, heating installation, for Davyhulme sewage works.—See 11 Nov. issue.

14 Dec.—Stockport T.C. Supply and erection of class B 80 W mercury vapour street lighting units, etc. Borough Surveyor, Town Hall.

17 Dec.—Roxburgh. Electrical installation in alteration to properties at Heitan Village. County Architect, County Offices, Newtown St. Boswells.

21 Dec.—Poole T.C. Installation by nominated sub-contractors of mechanical and electrical plant for Broadstone sewage disposal works. Consulting Engineers, J. D. and D. M. Watson, 18 Queen Anne's Gate, Westminster. Deposit £10. 10s.

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources including an index of trade information with over 100,000 entries

A Selection from the 120 queries answered this week

Washing machines, ultra-sonic type, suppliers of? F.S.L.—The importers of ultra-sonic washing aids are G.I. Developments, Ltd, 48 Moorgate, E.C.2, Brown Bros. and Co., Ltd, Gt. Eastern St, E.C.2.

"Collett" terminals, makers of? T.E.—S. H. Collett Mfg. Co., Ltd, 341 Goswell Rd, E.C.1.

Chrome plated electrically heated saucepans of about three pints capacity, makers of? S.E.B.—There is no such product being made at present, but we understand that the Dowsing Co. (Electrical Manfrs.) Ltd., Kangley Bridge Rd, S.E.26, have evolved a prototype which has not yet reached the production line.

"Sunglow" lighting fittings, makers of? T.B.C.—S. and W. Lighting Ltd, Church Lane, Dudley Port, Tipton, Staffs.

"Apex" lampshades, makers of? N.L. Apex Mfg Co., Ltd., 15 Bath St, E.C.1. This range is only supplied to F. W. Woolworth and Co., Ltd.

Carlisle Electrical Mfg. Co., Ltd., address of? S.E.B. — The address is Martin St, Audenshaw, Manchester. The stocks and unfinished switchgear made by this concern were taken over by the Dexray Eng. Co., Ltd., Brook St, Manchester.

23 Dec.—Dorchester T.C. Supply of electrical equipment for installation 63 mercury discharge lighting units on concrete and steel columns along trunk road A.35. Borough Engineer and Surveyor, Municipal Offices, North Sq. Deposit £1. 1s.—Advertised in this issue.

No date stated—Oxfordshire. Installation of electricity at secondary modern school at Watlington, secondary modern school at Kidmore End, and Witney grammar school. Apply to County Architect, Park End St Offices, Oxford.

No date stated.—N. of Scotland H.E. Board. Cabling, lighting, heating, etc., at Quioch and Invergarry Compensation Water Generating Stations. Kennedy and Donkin, 12 Caxton St, London, S.W.1. Deposit £2. 2s.—Advertised in this issue.

No date stated—N. of Scotland H.E. Board. Supply of medium voltage switchgear and ancillary equipment for Cluaine Dam Compensation and Loyne Tunnel Water Generating Stations. Kennedy and Donkin, engineers, 12 Caxton St, London S.W.1.—Deposit £2. 2s.—Advertised in this issue.

. . . and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon House, Theobalds Rd, W.C.1, quoting reference.*

6 Dec.—Australia. Supply of air break type circuit-breakers and current transformers, for Electric Supply Committee, Melbourne City Council, Town Hall, Melbourne. Tender No. 918/E. B.o.T. (Ref.: ESB 26119/54).*

13 Dec.—Egypt. Supply of tubular steel lighting standards and lanterns for Ports and Lighthouses Administration, Ministry of War and Marine. B.o.T. (Ref.: ESB 26466/54).*

14 Dec.—Uruguay. Usinas Electricas y los Telefonos del Estado invites tenders (No. 2330—Specification No. 4116/54) for supply of total of 660,000 metres of conductors with black protective covering for outdoors. B.o.T. (Ref.: ESB 26406/54).*

15 Dec.—India. Electrification of third railway track between Madras Egmore and Tambaram, Earnest money is Rs. 5,000. Documents from Chief Electrical Engineer, Southern Railway, Madras, at Rs.50 a set.

16 Dec.—Philippines. Two hydraulic turbines, two governors, and/or two generators, one power transformer, switchgear and station service equipment for Loboc River Hydroelectric project. Documents from General Manager, National Power Corpn., P.O. Box 2123, Manila, at five pesos per set. B.o.T. (Ref.: ESB 25228/54).*

17 Dec.—Uruguay. Tenders invited for supply of 17,500 different kinds of lamp holders and 30,000 lighting receptacles, normal "Edison" screw thread, without key, made of polished brass with covering of varnished white porcelain. Usinas Electricas y los Telefonos del Estado. B.o.T. (Ref.: ESB 26408/54).*

21 Dec.—U.S.A. Supply of 15 kV system electrical equipment (circuit-breakers, bus structures, switchgear, etc.) for Fish Turbine Bay generators and main units at the Dallas Dam. District Engineer, Corps of Engineers, U.S. Army, 628 Pittock Block, Portland 5, Oregon. Tender No. CIVENG-35-026-55-83. B.o.T. (Ref.: ESB 25987/54).*

24 Dec.—Uruguay. Supply of 9,000 neutral glass insulators and white porcelain insulators. Usinas Electricas y los Telefonos del Estado. B.o.T. (Ref.: ESB 26439/54).*

3 Jan.—India. Supply and erection of line materials for Theni-Sambatty 110 kV line, about 38 miles in length. Madras Electricity Dept., 157 Mount Rd, Madras. B.o.T. (Ref.: ESB 26115/54).*

7 Jan.—India. Director-General of Supplies and Disposals, Shahjahan Rd, New Delhi, requires supply of armoured railway signalling cable 660 V grade conductors. B.o.T. (Ref.: ESB 25526/54).*

10 Jan.—Jordan. Supply and erection of plant and equipment for Nablus. Specification NJ.1: Two 150 kW and two 300 kW diesel generator sets; specification NJ.2: four miles 6,600 V and 16 miles of 415 V o.h. pole line distribution; specification NJ.3: 6,600 V and 415 V switchgear; specification NJ.4: six 6,600/433 V indoor transformers. Kennedy and Donkin, Alliance Hse, 12 Caxton St, London, S.W.1. Deposit £3 on each specification. Closing date for specification NJ.2 is 31 Jan.—Advertised in this issue.

14 Jan.—Australia. Brisbane City Council require six 7,500 kVA 3-phase, 50 P.P.S. 33,000 V delta to 11,000/6,350 V star step-down outdoor transformers with oil and onload tap changing. Town Clerk, City Hall. B.o.T. (Ref.: ESB 26135/54).*

18 Jan.—New Zealand. Post and Telegraph Dept., Willis St, Wellington, invite tenders (P. and T. 150/7422) for supply of quantities of power cable and flexible cord. B.o.T. (Ref.: ESB 26128/54).*

26 Jan.—Australia. Supply of an internal combustion engine driven generating set with all accessories and auxiliaries for State Electricity Commission of Queensland, Scottish Union Hse, Eagle St, Brisbane. Tender No. 479. B.o.T. (Ref.: ESB 26098/54).*

1 Feb.—Kuwait. Three tenders invited as follows for supply of: (*a*) four 10 MW gas turbine driven alternators and auxiliaries; (*b*) four 10 MW steam turbine driven alternators and auxiliaries; and (*c*) four 125,000 lb/hr steam raising units and auxiliaries; all for new power station B. President of Dept. of Electricity, Govt. of Kuwait.—Advertised in this issue.

PRICES of cable metals and other materials

Figures quoted are the official prices ruling on Tuesday, 16 November

	£ per ton	Weekly change £	Price last year £
COPPER, standard class A (settlement)	279½	−½	238
„ (3 months)	267½	+2½	224½
LEAD, refined pig, min. 99·97% purity (cash)	110½	−½	93½
„ (3 months)	105½	+¼	90½
TIN, refined, min. 99·75% purity (settlement)	725	+5½	630
„ (3 months)	720	+2½	620
ALUMINIUM, ingots 99-99·5%	150	—	150
ZINC, virgin, min. 98% purity (cash)	82	+⅛	75⅝
„ (3 months)	82	+⅜	74½
RUBBER No. 1, RSS. spot (per lb.)	25½d.	−1d.	16⅝d.
„ c.i.f. basis, ports, Dec. (per lb.)	23⅝d.	−$\frac{9}{16}$d.	16⅝d.
ARMOURING:			
Galv. Steel Wire (0·104 in.)	52½	—	50½
Mild Steel Tape (0·014 in.)	40½	—	40

Contracts Placed

B.E.A. Two 72 MVA 34·8/11·6 kV generator transformers at Brighton B, English Electric Co., Ltd.; 33 kV and l.v. cables and accessories at Brimsdown B, Aberdare Cables, Ltd.; two 36 MVA 11·8/33·4 generator transformers at Bold A, Metropolitan-Vickers Electrical Co., Ltd.; circulating water pumps, pipework, valves and strainers at Portobello, Drysdale and Co. Ltd.; standardised indication and telephone equipment in Bristol and Birmingham Grid control areas, General Electric Co., Ltd.; same in Thames North and Leeds Grid control areas, Standard Telephones and Cables Ltd.; 132 kV 3,000 MVA switchgear at Agecroft substation, Metropolitan-Vickers Electrical Co., Ltd.; 275 kV 7,500 MVA switchgear at Pemwortham substation, Ferguson Pailin, Ltd.; modifications to 132 kV switchgear and equipment at Warrington substation, Ferguson Pailin, Ltd.; and 132 kV 2,500 MVA switchgear at Dalmarnock substation, Metropolitan-Vickers Electrical Co., Ltd.

Dartford T.C. Street lighting along trunk road A.2 and Princes Rd North, Cohen Bros. (Electrical) Ltd., £7,192.

Dudley T.C. Street lighting in New Rowley Rd, Pensnett Rd, and Grange Rd, Revo Electric Co., Ltd., £2,563.

Grantham T.C. Conversion scheme for various streets), General Electric Co., Ltd., £16,207.

Larne (Antrim) T.C. Equipment for street lighting improvement scheme, British Thomson-Houston Co., Ltd., £11,406.

Stockton-on-Tees T.C. Electrical subcontracts for housing, J. Emmerson, £2,511.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Livia. B732,634. Class 11. Lamp bulbs, torches and hand-lamps. S. D. Sullam Ltd., Africa House, Kingsway, W.C.2.

Eldorado. 733,595. Class 11. Refrigerating cabinets. Eldorado Ice Cream Co. Ltd., 14 West Smithfield, E.C.1.

Insowax. 732,551. Class 17. Insulating materials. Technical Waxes Ltd., 24 Market St, Manchester 1.

Passivated. 732,815. Class 17. Insulating oils. Manchester Oil Refinery (Holdings) Ltd., 17 Stratton St, Piccadilly, W.1.

Whirligay. 731,973. Class 7. M. Yager and S. Ross, 22 Wardour St, W.1.

Necob. 732,279. Class 7. Dynamo electric machines, lathes, etc. 732,280. Class 9. Scientific, nautical, surveying and wireless apparatus, etc. 732,281. Class 11. Nuclear and Electronic Co., Ltd., 8 South Wharf, Paddington, W.2.

BUSINESS PROSPECTS

Home

Brigg (Lincs.) R.D.C. It is proposed to erect 500 houses in 40 parishes during next five years at the rate of 100 houses per year.

Bristol T.C. Scheme being considered for erection by Sodbury R.D.C. of 3,000 dwellings in Yate/Chipping Sodbury area, and 1,000 houses in Little Stoke/Patchway area to cater for Bristol overflow.

Cambridge T.C. Erection of secondary modern school on Ventress Farm estate. City Surveyor, The Guildhall.

Colchester T.C. Erection of three 3-storey blocks of flats. J. S. Orchard, borough engineer, 1 West Stockwell St.

Dublin T.C. Erection of 178 houses in Finglas West area. City Treasurer, Exchange Buildings, Lord Edward St.

Glasgow. Dean of Guild Court has approved erection of multi-storey building in John St for Royal Technical College. Cost estimated at £260,000.

Hinckley (Leics.) U.D.C. It is proposed to build 27 blocks comprising 108 flats on Sketchley Hill estate.

Inverness T.C. Dean of Guild Court has approved housing scheme estimated to cost over £250,000 and comprising 180 flats.

Islington B.C. Erection of two 8-storey blocks of dwellings containing 76 units in Elizabeth Ave. Town Clerk, Islington Town Hall, Upper St, N.1.

Knutsford (Ches.) U.D.C. Erection of total of 96 dwellings at Shaw Heath. G. R. Butler, Surveyor, Council Offices.

Leicestershire. New secondary modern school to be built at Colville early next year.

Lincolnshire. Holland C.C. to erect £160,000 secondary modern school at Holbeach and first instalment (costing £100,000) expected to be started next spring.

Mitcham (Sur.). G. B. A. Williams, 282 Kensington High St, W.8, is architect for factory proposed by Coloquid Cellulose Ltd.

Newcastle-on-Tyne. Preliminary plans approved for proposed Rutherford High School to cost £206,000.

Nottinghamshire. School building programme for 1955-56 includes 10 schools and is estimated to cost £673,903.

Rochester T.C. Installation of electricity in 36 flats in Corporation St approved.

Ruislip-Northwood (Middx.). Tenders may soon be invited for erection of Harlyn Drive junior school. Estimated cost £56,400.

Salisbury T.C. Construction of 34 dwellings on Primrose estate. City Engineer, The Council Hse, Bourne Hill.

Slough. I.C.I. Paints Division have begun £1,500,000 expansion scheme. Start made on expansion of research and development laboratory.

South Shields T.C. £800 to be spent on rewiring Mowbray Rd school.

St. Albans T.C. Approval given to installation of lighting for stalls at Saturday St Market. Cost estimated at £1,000.

Sunderland. Three-year shipyard modernisation scheme to be carried out by Austin and Pickersgill Ltd. Cost estimated at £1,100,000.

Thornton Cleveleys U.D.C. Erection of about 50 houses on Halton Ave estate. H. Anderson, Engineer and Surveyor, Council Offices, Fleetwood Rd.

Wrexham T.C. Approval granted to plans for 3-storey municipal offices at Llwyn Gsaf. Cost estimated at £97,730.

Overseas

Cuba. Frederick Suare Corporation, Prado 360, Havana, are interested in receiving quotations from U.K. manufacturers of generating plant to certain specifications.

El Salvador. Offers from U.K. manufacturers for supply of domestic electric consumption meters of following types wanted: Watt/ohm meters, 110 V, 60 c/s, single-phase, 10, 15 and 30 A with transparent cover for easy reading. Offers sought by Keilhauer, Pagram y Co., la Avenida Norte No. 36, San Salvador, El Salvador.

India. Mr M. Nath, managing director of Electrical Machines Corporation Ltd., D-33 Ganesh Chandra Ave., Calcutta 13, is to visit U.K. next Feb. to buy certain machinery for an associated company, Electrical Manufacturing Co. Ltd., who produce material for high-power transmission lines.

South Africa. Mr W. Trevor Williams of Ussher Industries (Pty.) Ltd., P.O. Box 563, Durban, will be coming to the U.K. next month to obtain agencies for electrical wiring and tubing, and domestic electrical equipment, and electric lamps. He is seeking agencies on behalf of Northern and King (Pty.) Ltd., a firm in which he is interested.

TRADE NOTES

Change of Name. The directors of R. Lowther Ltd., announce that the name of the company has been changed to Arrell Electrical Accessories Ltd.

Change of Address. The Leeds branch office and cable depot of Standard Telephones and Cables Ltd., has moved to: Newport Cable Division, 6/8 York Place, Leeds, 1. Telephone Leeds 22900. The manager is Mr L. Tillotson.

E.W.F. Metropolitan Distribution Ltd., 9 River St, Truro, has been elected a member of the Electrical Wholesalers Federation.

Beama Contract Price Adjustment Formulæ.—*For Electrical Machinery and Equipment.* For purposes of calculating variations in: (*a*) "Rates of Pay"—the rate of pay for adult male labour at 13 Nov., 1954, shall be deemed to be 150s. 6d.; (*b*) "Cost of Material"—the index figure for materials used in the Electrical Machinery Industry published in the Board of Trade Journal on 13 Nov., 1954, is 167·5.

For Turbo-Generating and Allied Plant. For purposes of calculating variations in: (*a*) "Rates of Pay"— the rate of pay for adult male labour at 13 Nov., 1954, shall be deemed at 150s. 6d. (*b*) "Cost of Material"—the index figures published in the Board of Trade Journal on 13 Nov., 1954, are: Materials used in Mechanical Engineering Industries—154·5, "Blast Furnaces and Iron and Steel Melting and Rolling (40 and 41)"—146·3. The price of brass condenser tubes, ¾ in. o/d 18 s.w.g. published in *The Metal* Bulletin on 12 Nov., is 3s. 10d. per lb.

For outstanding Contracts covered by the B.O.T. Intermediate Products Index. For purposes of calculating variations in (*a*) "Rates of Pay"— the rate of pay for adult male labour at 13 Nov., 1954, shall be deemed to be 150s. 6d.: (*b*) "Cost of Material"—the index figure for Intermediate Products published in the Board of Trade Journal on 13 Nov., is 363·3.

Gazette Announcements

COMPANIES ACTS

Partnership Dissolved

Lewis and Raby. Partnership between Reginald Raby, Robert S. Raby, Thomas Raby and James Lewis, trading under above title as electrical engineers in Newstet Rd, Kirkby, and at 28 Russell St, Liverpool, dissolved as from 1 Nov. Debts received and paid by R. Raby, R. S. Raby and T. Raby, who will continue business.

Voluntary Liquidation

J. Weetch and Sons Ltd., electrical engineers. At meeting of creditors statement of affairs submitted showed liabilities of £3,139 of which £2,400 was due to trade creditors; £500 loans; £54 to Bank; and £184 8s. 6d. to expense creditors. Assets of a book value of £941 were estimated to realise £520, and after allowing £198 for preferential claims, there were net assets of £321, or a deficiency as regards creditors of £2.817. Resolution passed confirming voluntary liquidation. Mr R. Langdon Davis, C.A., 58 Theobalds Rd, London, W.C.1, is liquidator, with committee of inspection.

S. and T. Martin Ltd. Liquidator, R. F. Howe, Official Receiver, of 4 Bridge Rd, Stockton-on-Tees, released from 3 Nov.

University Camera and Radio Co., Ltd. Meetings of creditors and contributories will take place at Inveresk Hse, (Room 401), 346 Strand, London, W.C.2, on 24 Nov. at 11.30 a.m. and 12 noon resp.

Cox's Radio and Electrical Co., Ltd. Resolution for voluntary winding-up passed at meeting on 8 Nov. E. F. Beardsmore of National Provincial Bank Chambers, Five Ways, Birmingham, has been appointed liquidator and creditors are asked to send particulars to him by 31 Dec.

Aircraft and Garage Equipment Ltd. Resolution for voluntary winding-up passed at meeting on 8 Nov. R. P. Booth, C.A., of 5 Rumford Place, Liverpool, was appointed liquidator.

Hydro Pulsator Co., Ltd. At meeting on 29 Oct. resolution passed for voluntary winding-up with K. Jackson, 158 High St, Wealdstone, Middlx, as liquidator.

Hockley Electric Motor and Engineering Ltd. Meeting of members will be held on 13 Dec. at 3 Lloyd Rd, Broadstairs, Kent, at 12 noon, to receive liquidator's report.

BANKRUPTCY ACTS

Application for Discharge

Manchester. Frank J. Crutchley, trading as Frank Crutchley, electrical engineers, at 9 York St, Hulme. Hearing fixed for 10.15 a.m. on 13 Dec. at The Court Hse, Quay St, Manchester.

Intended Dividends

Guildford. Ronald H. Winslade, electrical engineer of 21 Park Rd, Aldershot. Last day for receiving proofs, 1 Dec. Trustee is N. W. Osborne, 11-12 Finsbury Sq, London, E.C.2.

MEETINGS TO NOTE

THURSDAY, 18 NOV.

I.E.E. (London Utilisation). "Use of Electricity in Production of Calcium Carbide," C. J. Beavis. Savoy Place, W.C.2, 5.30 p.m.

I.E.E. (E. Midland). Centre Buffet Dance at Welbeck Hotel, Nottingham.

I.E.E. (Irish). "Service Experience of Effect of Corrosion on Steel-Cored-Aluminium o.h. Line Conductors," J. S. Forrest and J. M. Ward. Trinity College, Dublin, 6 p.m.

INCORP. PLANT ENGRS. (Blackburn). "Gas Turbines," J. R. Needham. Golden Lion Hotel, 7.30 p.m.

INCORP. PLANT ENGRS. (Mersey and N. Wales). "Factory Act and Plant Engineer," A. Mills, Radiant Hse, Bold St, Liverpool, 7.15 p.m.

A.S.E.E. (Kent). "Relays." Dr W. L. Stern. Royal Star Hotel, Maidstone, 8 p.m.

A.S.E.E. (Watford). Television at Clarendon Hotel, Station Rd, 8 p.m.

FRIDAY, 19 NOV.

I.E.E. (N.E. Students). "D.C. Auxiliary Supplies for Switchgear and Associated Equipment," J. T. Miller. King's College, Newcastle, 6.30 p.m.

DERBY ELECTRICAL SOC. Annual dinner at Grandstand Hotel.

NORTH EAST ELECTRICAL CLUB. Annual dinner.

JNR. INSTN. OF ENGINEERS (London). Chairman's address "Engineering Plant in Buildings," S. G. Clark. Pepys Hse, 14 Rochester Row, S.W.1, 7 p.m.

INCORP. PLANT ENGRS. (E. Midlands). Ladies' evening at Black Boy Hotel, Nottingham.

INCORP. PLANT ENGRS. (Manchester). Annual dinner at Grand Hotel.

I.E.E. (N. Midland). Annual dinner at Queens Hotel, Leeds.

ASSOC. OF ELECT. MACHINERY TRADES. Annual Ball at Savoy Hotel, London, 6.30 p.m.

SATURDAY, 20 NOV.

I.E.E. (Cambridge). District Dinner at Dorothy Restaurant, 7 p.m.

MONDAY, 22 NOV.

I.E.E. (London Radio). "Plastics for Radio Engineer." Savoy Place, W.C.2, 5.30 p.m.

I.E.E. (N. Eastern). "Service Experience of Effect of Corrosion on Steel-Cored-Aluminium Overhead-Line Conductors," J. S. Forrest and J. M. Ward. Neville Hall, Westgate Rd, Newcastle, 6.15 p.m.

I.E.E. (S. Midland Radio). "Loudspeaker Systems—Recent Trend in Design," Maj A. E. Falkus. James Watt Memorial Inst., Great Charles St, Birmingham, 6 p.m.

I.E.E. (N. Staffs). "Short-Circuit Forces on Turbo-Alternator End Windings," by J. B. Young and D. H. Tompsett; and "Electrical Measurement of Steam Turbine Rotor Movements, especially Design and Operation of Modern Plant," by J. L. Ashworth, J. S. Hall and A. H. Gray. Tech. College, Stafford, 7 p.m.

I.E.E. (Western Utilisation). "Electrical Planning for Modern Cigarette Factory," J. M. Druce and R. H. Cobbold. Elect. Hse, Colston Ave, Bristol, 6 p.m.

I.E.S. (Leeds). "New Lamps, New Uses and New Lighting Techniques," R. V. Mills. E.L.M.A., 24 Aire St, 6.15 p.m.

I.E.S. (Leicester). "History and Development of Lighting," L. H. Hubble. Elect. Offices, Charles St, 6 p.m.

COVENTRY ELEC. CLUB. "Germicidal Radiation," D. H. Holloway. Elect. Sports and Social Club, Merrick Lodge, St. Nicholas St.

A.S.E.E. (Bournemouth). "Electrics in Modern Aircraft," C. J. Foote. Grand Hotel, 8.15 p.m.

TUESDAY, 23 NOV.

I.E.E. (London Measurements). "Application of the Hall Effect in a Semi-Conductor to the Measurement of Power in an Electromagnetic Field," Prof H. E. M. Barlow; "Audio-Frequency Power Measurements by Dynamometer Wattmeters," A. H. M. Arnold. Savoy Place, W.C.2, 5.30 p.m.

I.E.E. (London Students). "Attitudes of Mind," A. R. Cooper. Savoy Place, W.C.2, 6.30 p.m.

I.E.E. (E. Midland). "Telemetering for System Operation," R. H. Dunn and C. H. Chambers. Gas Dept., Demonstration Theatre, Nottingham, 6.30 p.m.

I.E.E. (N. Midland Utilisation). "Electric Lifts in Post-War Housing," C. G. Morley. Elect. Offices, 1 Whitehall Rd, Leeds, 6.30 p.m.

I.E.E. (N.W. Measurements) "Magnetic Measurement of Mechanical Hardness," by D. Hadfield; and "Determination of Static and Dynamic Elastic Properties of Resilient Materials," by R. S. Jackson, A. J. King and C. R. Maguire. Engrs. Club, Albert Sq, Manchester, 6.15 p.m.

I.E.S. (London). "Light and Crime Detection," C. H. Edlin. Lighting Service Bureau, Savoy Hill, W.C.2, 6 p.m.

SCIENTIFIC INSTRUMENT MANUFACTURERS' Assoc. Electronics Symposium and Exhibition at Birmingham Chamber of Commerce. Close on 25 Nov.

X-RAY APPARATUS EXHIBN. Open at Royal Horticultural Hall, Vincent Sq, London, until 26 Nov.

WEDNESDAY, 24 NOV.

I.E.E. (London Supply). "Supervisory Equipment for Indication of Shaft Distortion in Steam Turbines," D. Antrich, H. W. B. Gardiner, R. K. Hilton; "Electrical Measurement of Steam-Turbine Rotor Movements, especially Operation and Design of Modern Power Plant," J. L. Ashworth, J. S. Hall and A. H. Gray. Savoy Place, W.C.2, 5.30 p.m.

I.E.E. (N.W. Radio). "Manchester—Kirk o'Shotts TV Radio Relay Systems," C. Dawson, L. L. Hall, K. G. Hodgson, R. A. Meers and J. H. H. Merriman. Telephone Hse, Chapel St, Salford, 6.45 p.m.

BATTI-WALLAHS SOC. Monthly lunch.

BRITISH INSTN. OF RADIO ENGRS. (London). "Development and Design of Direct Coupled Oscilloscopes for Industry and Research," M. J. Goddard. School of Hygiene, Keppel St, W.C.1, 6.30 p.m.

THURSDAY, 25 NOV.

I.E.E. (E. Midland). "Safety in Use of Portable and Transportable Electrical Equipment in Industry," J. W. Bunting. George Hotel, Kettering, 6.30 p.m.

I.E.E. (S. Midland). "Colour TV," C. J. Hirsch. Winter Gardens Restaurant, Great Malvern, 7.15 p.m.

I.E.E. (S. Western). "Fluorescent Discharge-Tube Circuits and Operating Problems," J. Cates. Elect. Offices, Taunton, 3 p.m.

I.E.S. (Birmingham). "Gemology," F. Hessling. Regent Hse, St. Phillip's Place, Colmore Row, 6 p.m.

INST. OF FUEL (London), "Peat-fired Power Stations." W. Cronin and J. F. Lang. Instn. of Civil Engineers, Great George St, S.W.1, 5.30 p.m.

E.I.B.A. (Hants and Dorset). Fifth annual ball at S. Parade Pier Pavilion, Southsea.

INCORP. PLANT ENGRS. (Sheffield). "Compressed Air in Industry." Grand Hotel, 7.30 p.m.

E.P.E.A. (S.W. Tech. Group), "Fuse Design," K. Dannenberg.

FRIDAY, 26 NOV.

I.E.E. (E. Midland). "A Radio Position Fixing System for Ships and Aircraft," C. Powell. College of Technology, Leicester, 6.30 p.m.

I.E.E. (N. Staffs). Annual dance at Crown Hotel, Stone, 8.30 p.m.

I.E.E. (Southern). "Electric Fuses and Circuit-Breakers," E. W. Baxter. Tech. College, Weymouth, 6.30 p.m.

I.E.S. (Bath and Bristol). "Lighting for Enjoyment," T. O. Freeth. Elect. Offices, Old Bridge St, Bath, 7 p.m.

MANCHESTER ASSOC. OF ENGRS. "Submarine Telegraph and Telephone Cables," F. Mattingley. Engrs. Club, Albert Sq, 6.45 p.m.

INCORP. PLANT ENGRS. (Birmingham). Ladies' evening. "Laundries," G. N. Freck. Imperial Hotel, 7.30 p.m.

INCORP. PLANT ENGRS. (Peterborough). Annual dinner at Dujon Cafe, Market Place.

E.P.E.A. "Oil Filled Cables" at Southampton.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons, Ltd., 116 Chancery Lane, W.C.2.

Tecumseh (Great Britain) Ltd. To acquire whole or part of undertaking, assets and liabilities of L. Sterne and Co., Ltd., refrigeration, general, mechanical, automobile, aeronautical, electrical, civil and constructional engineers, etc. Nom. cap.: £100. Dirs.: to be appointed by subs. Subs.: F. M. Baxter and M. I. Wordley, 6 Austin Friars, E.C.2.

Griffith and Holliday Ltd. 12 Station Rd, Workington. To take over business of electrical contractors and general dealers carried on as "Griffith and Holliday" at 12 Station Rd, Workington, and 16 Wampool St, Silloth. Nom. cap.: £3,000. Dirs.: R. B. Griffith and others to be appointed by subs.

Re-View (London) Ltd. Kings Chambers, 29/31 Portugal St, W.C.2. Repairers, rebuilders and reconditioners by reactivation or otherwise of cathode-ray tubes, radio, television and any other kinds of electrical equipment, etc. Nom. cap.: £1,000. Dirs.: J. Mulholland and J. Darling.

Threestoks Ltd. 51a Victoria Park Rd, E.9. Electrical and mechanical engineers and contractors, etc. Nom. cap.: £100. Dirs.: A. E. Stokes and J. F. Stokes.

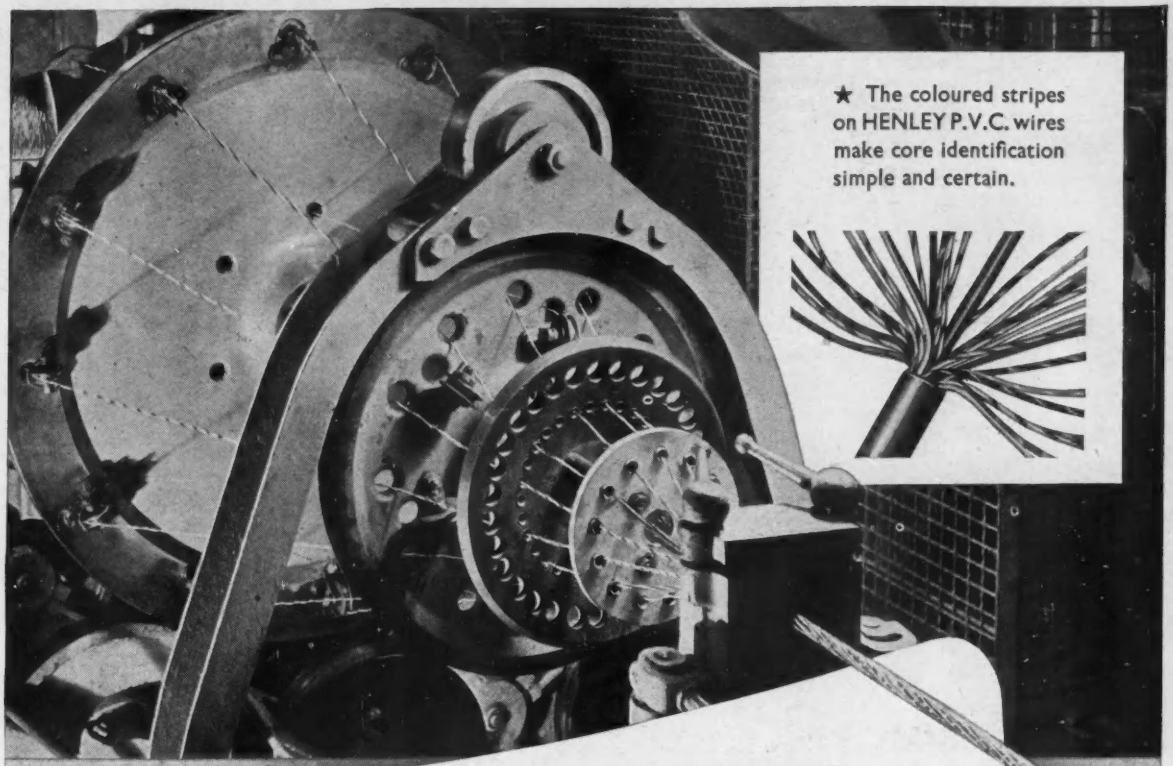
British Northern Electrical Appliances (Ilkley) Ltd. Nom. cap.: £5,000. Dirs.: to be appointed by subs. Subs.: S. H. Sheen, Quarry Hill Farm, Bardsey, nr. Leeds, and D. W. Bradley, 40 Oakwell Mount, Leeds 8.

E. J. Mills Ltd., 18a, Holtshill Lane, Walsall. Electrical, mechanical, motor and general engineers, etc. Nom. cap.: £6,000. Dirs.: E. J. C. Swain and S. L. Ince.

Leo Computors Ltd. Manufacturers of and dealers in electrical or automatic computors and office machinery and automatic control equipment, etc. Nom. cap.: £100. Dirs.: to be appointed by subs. Subs.: C. F. Miller and Marie L. Froehlich, 199 Piccadilly, W.1.

Companies incorp. outside G.B. having established places of business within G.B.

Air Ltd., Brit. add., 3 Cork St, W.1. Registered in Bahama Islands on 5 May, 1954, to acquire patents, etc., relating to manufacture, production assembling, treatment, storage or use of air conditioning and refrigerating units, ice making machinery, etc. Nom. cap.: £20,000. Name of person authorised to accept service: E. H. Simmonds, Weir Cottage, Knighton, Radnorshire.



★ The coloured stripes on HENLEY P.V.C. wires make core identification simple and certain.

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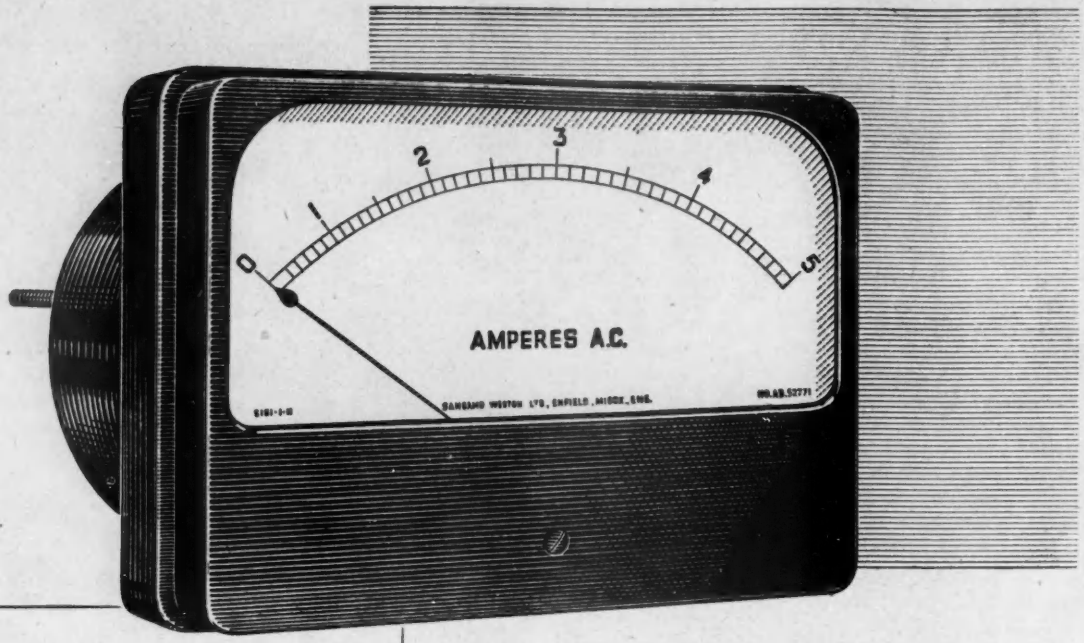
Henley's manufacture a very comprehensive range of wires, cables and flexibles insulated with P.V.C. and Polythene for Telecommunications, High Frequency, Television Down Leads, Equipment Wires, etc. Where colour identification of cores is required, the Henley dual marking method provides an extremely wide range of colour combinations. If you have a problem concerning thermoplastic cables Henley's advice is readily available.

★ **Ask for Folder 484 describing HENLEY Colour Striped P.V.C. Wires**

BY APPOINTMENT ELECTRIC CABLE MANUFACTURERS

W. T. HENLEY'S TELEGRAPH WORKS CO. LTD., 51-53 HATTON GARDEN, LONDON, E.C.1



WESTON ELECTRICAL INSTRUMENTS INCLUDE:–

LABORATORY STANDARDS

SUB STANDARDS

PORTABLE INSTRUMENTS

ROUND, RECTANGULAR AND EDGEWISE SWITCHBOARD AND PANEL INSTRUMENTS

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AIRCRAFT INSTRUMENTS

THE WESTON RANGE OF RECTANGULAR INSTRUMENTS

These instruments, giving the advantage of long, easily read scales, are designed to harmonize with rectangular panels and are offered in a variety of types and scale ranges.

Supplied as D.C. moving coil, A.C. rectifier and H.F. thermocouple types; also A.C./D.C. moving iron types.

Four sizes are available with scale lengths of 2·5″, 3·2″, 4·2″ and 6·25″.

Front of panel or back of panel mounting may be adopted as desired and if the former method is used, there is complete interchangeability with existing round models.

The 3·2″ and 4·2″ scale instruments are available with either illuminated or non-illuminated dials; the 2·5″ and 6·25″ scale instruments being available only with non-illuminated dials.

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CLASSIFIED ADVERTISEMENTS

Advertisements should be sent to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia Street, London, W.C.2, before 10 a.m. on TUESDAY of the week of issue. Official Displayed Advertisements are charged at 32s. 6d. per inch, and all other classified advertisements at 2s. 6d. per line. Situations Wanted four insertions at twice the single insertion rate. Fee for Box Number and postage on replies 2s.

TENDERS INVITED

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

MORISTON PROJECT MEDIUM VOLTAGE SWITCHGEAR AND ANCILLARY EQUIPMENT FOR CLUANIE DAM COMPENSATION AND LOYNE TUNNEL WATER GENERATING STATIONS

TENDERS are invited for the provision of the above-mentioned Switchgear and Equipment. Copies of the Tender Document may be obtained on application with cheque for Two Guineas (returnable), to the Engineers, Messrs Kennedy and Donkin, 12 Caxton St, London, S.W.1.

The Board do not bind themselves to accept the lowest or any Tender.

W. D. D. FENTON,
Secretary.

16 Rothesay Ter,
Edinburgh 3. (N 759)

URBAN DISTRICT COUNCIL OF CONNAH'S QUAY

STREET LIGHTING MAIN COAST ROAD, A.548

TENDERS are invited for the supply and erection of 47 Nos. Class A Lighting concrete columns and sodium lamps, together with auxiliary gear and wiring.

Specification and form of tender may be obtained from the Surveyor, Council Offices, High St, Connah's Quay, on payment of £2. 2s., to be refunded on receipt of bona fide tender.

Tenders, in plain sealed envelopes, endorsed "Tender—Street Lighting," to be delivered to the undersigned on or before 3 Dec., 1954.

The Council are not bound to the lowest or to accept any tender.

L. WILLIAMS,
Clerk of the Council.

Council Offices,
Connah's Quay.
15 Nov., 1954. (N763)

GOVERNMENT OF KUWAIT

DEPARTMENT OF ELECTRICITY
POWER STATION "B"

TENDERS are invited for the supply of 4—125,000 lb/hr Steam Raising Units and Auxiliaries for the above New Power Station. The Tender Documents will be available in Kuwait on the 29 Nov., 1954. A single copy of the Tender Documents must be obtained from the President of the Department of Electricity, Government of Kuwait, Kuwait, Persian Gulf, and will only be available to recognised and accredited Kuwaiti Agents. The necessary additional copies of the Tender Documents will be issued by the Consulting Engineers in London on receipt of the Authorisation Form from the Government of Kuwait. Notice of the foregoing will be posted on the notice board of the Department of Electricity in Kuwait on 22 Nov., 1954. The Tenders to be submitted to the President of the Department of Electricity, Kuwait, Persian Gulf, by 1 Feb., 1955.

Ewbank and Partners Ltd.,
Engineering Consultants.

10/11 Grosvenor Place,
London, S.W.1. (N 708)

BOROUGH OF MORLEY

STREET LIGHTING A.650

TENDERS are invited for the supply and installation of 42-140 W sodium lighting units on Trunk Road A.650.

The works are divided as follows:

Part A Supply of electrical equipment (lanterns, lamps, control gear and timeswitches).

Part B Supply and Erection of Columns, together with fitting and wiring of electrical equipment offered in Part A.

Part C Supply and Erection of Columns, together with fitting and wiring of electrical equipment provided by another firm.

Offers may be made for separate parts or all parts.

Specifications and forms of tender, upon payment of a deposit of 10s. 6d. which will be refunded after the receipt of bona fide tenders, will be supplied by the Street Lighting Superintendent, Town Hall, Morley, to whom completed forms should be returned not later than 3 Dec., 1954.

E. V. FINNIGAN,
Town Clerk.

Town Hall,
Morley, Yorks. (N 760)

BOROUGH OF DORCHESTER

STREET LIGHTING

TENDERS are invited for the supply of electrical equipment and for the installation of 63 No. Mercury Discharge Lighting Units on concrete and steel columns on Trunk Road No. 37 (A.35). The work includes the removal of the existing lighting equipment.

The General Conditions, Specifications, Bills of Quantities and Drawings may be inspected at the office of, and copies of the Specifications, Bills of Quantities and Form of Tender may be obtained on payment of a deposit of £1. 1s. (returnable on receipt of a bona fide tender) from the Borough Engineer and Surveyor, Municipal Offices, North Square, Dorchester.

Tenders, in plain sealed envelopes, endorsed "Street Lighting," must be received by the undersigned not later than noon on Thursday, 23 Dec., 1954.

The Council do not bind themselves to accept the lowest or any tender.

F. P. LAKE SYDENHAM,
Town Clerk.
(N 758)

CITY OF MANCHESTER
Housing Committee

TENDERS are invited for Electrical Installations on the following sites:

Contract 213—Hermitage Road, Crumpsall —10 houses.

Contract 215—New Cross No. 4—80 Maisonnettes and Flats.

Schedules and tender forms may be obtained on application to the Director of Housing, Town Hall, Manchester 2, and must be returned in a sealed official envelope endorsed "Electrical Installations," and be received by the Town Clerk not later than noon on Friday, 26 Nov., 1954.

PHILIP B. DINGLE,
Town Clerk.
(N 704)

MUNICIPAL CORPORATION OF NABLUS

Tenders are invited for supply, delivery and erection of plant and equipment for Nablus in the Hashemite Kingdom of Jordan.

Any or all of the following Specifications can be obtained on application to Kennedy and Donkin, Alliance Hse, 12 Caxton St, London, S.W.1, on payment of Three Pounds (Sterling) (non-returnable) for each Specification:

Specification NJ.1 Two 150 kW and two 300 kW Diesel Generator Sets.

Specification NJ.2 4 Miles (6½ kilometers) of 6,600 V and 16 Miles (26 kilometers) of 415 V Overhead Pole Line Distribution.

Specification NJ.3 6,600 V and 415 V Switchgear.

Specification NJ.4 Six 6,600/433 V Indoor Distribution Transformers.

Tenders are to be prepared in duplicate. The original is to be posted to the Mayor of Nablus, and the copy is to be posted to Kennedy and Donkin, so that they are received not later than 10 Jan., 1955, except for Specification NJ.2, which shall not be later than 31 Jan., 1955.

The Corporation do not undertake to accept the lowest or any Tender.

The Engineers for the whole of the Work will be Messrs. Kennedy and Donkin, Alliance Hse, 12 Caxton St, London, S.W.1.

MAYOR OF NABLUS,
Hashemite Kingdom of Jordan.
(N 705p)

GOVERNMENT OF KUWAIT

DEPARTMENT OF ELECTRICITY
POWER STATION "B"

TENDERS are invited for the supply of 4—10,000 kW Steam Turbine-driven Alternators and Auxiliaries for the above new Power Station. The Tender Documents will be available in Kuwait on 29 Nov., 1954. A single copy of the Tender Documents must be obtained from the President of the Department of Electricity, Government of Kuwait, Kuwait, Persian Gulf, and will only be available to recognised and accredited Kuwaiti Agents. The necessary additional copies of the Tender Documents will be issued by the Consulting Engineers in London on receipt of the Authorisation Form from the Government of Kuwait. Notice of the foregoing will be posted on the notice board of the Department of Electricity in Kuwait on 22 Nov., 1954. The Tenders to be submitted to the President of the Department of Electricity, Kuwait, Persian Gulf, by 1 Feb., 1955.

Ewbank and Partners Ltd.,
Engineering Consultants.

10/11 Grosvenor Place,
London, S.W.1. (N 707)

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

GARRY PROJECT CABLING, ELECTRIC LIGHTING, HEATING AND OTHER SUBSIDIARY SERVICES AT QUOICH AND INVERGARRY COMPENSATION WATER GENERATING STATIONS

TENDERS are invited for the above installations. Copies of the Tender Document may be obtained on application, with cheque for Two Guineas (returnable) to the Engineers, Messrs. Kennedy and Donkin, 12 Caxton St, London, S.W.1.

The Board do not bind themselves to accept the lowest or any Tender.

W. D. D. FENTON,
Secretary.

16 Rothesay Ter,
Edinburgh 3. (N 736)

GOVERNMENT OF KUWAIT

DEPARTMENT OF ELECTRICITY
POWER STATION "B"

TENDERS are invited for the supply of 4—10,000 kW (or nearest standard size of between 8,000 and 12,000 kW) Gas Turbine-driven Alternators and Auxiliaries for the above new Power Station. The Tender Documents will be available in Kuwait on 29 Nov., 1954. A single copy of the Tender Documents must be obtained from the President of the Department of Electricity, Government of Kuwait, Kuwait, Persian Gulf, and will only be available to recognised and accredited Kuwaiti Agents. The necessary additional copies of the Tender Documents will be issued by the Consulting Engineers in London on receipt of the Authorisation Form from the Government of Kuwait. Notice of the foregoing will be posted on the notice board of the Department of Electricity in Kuwait on 22 Nov., 1954. The Tenders to be submitted to the President of the Department of Electricity, Kuwait, Persian Gulf, by 1 Feb., 1955.

Ewbank and Partners Ltd.,
Engineering Consultants.
10/11 Grosvenor Place,
London, S.W.1. (N 706)

CITY OF MANCHESTER
Housing Committee

TENDERS are invited for Electrical Installation to 16 Maisonnettes and Flats at Contract 194, Cambridge Street, Hulme.

Tender Forms and Schedules may be obtained on application to the Director of Housing, Town Hall, Manchester 2, and must be returned in a sealed official envelope endorsed "Electrical Installations," and be received by the Town Clerk not later than noon on Friday, 26 Nov., 1954.

PHILIP B. DINGLE,
Town Clerk.
(N 703)

APPOINTMENTS VACANT

Engagement of persons must be made through a Local Labour Office or Scheduled Employment Agency, if the applicant is a man aged 18–64, or a woman aged 18–59; unless the person concerned is excepted or the employment is in a managerial or professional capacity, or is otherwise excepted from the provisions of the Notification of Vacancies Order, 1952.

MINISTRY OF EDUCATION
Science Museum

THE Civil Service Commissioners invite applications for the post of ASSISTANT KEEPER in the Department of Electrical Engineering and Communications. The appointment may be First or Second Class according to age and qualifications.

Age at least 22 and under 26 (26 or over if exceptionally well qualified) on 1 Nov., 1954, for a Second Class post, with extension for regular Forces Service, compulsory Forces Service and established Civil Service. Prospect of promotion to First Class post by age 30. For direct appointment to a First Class post candidates must be at least 28 on 1 Nov., 1954.

Candidates must have a First or Second Class Honours degree in electrical engineering, or such equivalent qualification as would be accepted by the Commissioners, and about two years' experience in industry. Knowledge of at least one modern foreign language an advantage.

Salary scale: Assistant Keeper First Class—Men, £895/£1,430; Women, £765/£1,260. Starting pay at the minimum.

Assistant Keeper Second Class—Men, £470/£685; Women, £470/£580. Starting pay may be increased for approved post-graduate experience and for compulsory service with H.M. Forces.

Particulars and application forms from Civil Service Commission, Scientific Branch, 30 Old Burlington St, London, W.1, quoting No. S270/54. Application forms to be returned by 14 Dec., 1954. (N 720)

THE NORTH WESTERN ELECTRICITY BOARD

APPOINTMENT OF (*a*) GENERAL ASSISTANT ENGINEER (APPLIANCE TESTING) (*b*) GENERAL ASSISTANT ENGINEER (WORKSHOP SUPERVISOR) DOMESTIC APPLIANCE WORKSHOP, WALKDEN

APPLICANTS for post (*a*) should have experience of routine and type testing and be capable of preparing reports dealing with the construction and performance of all types of electrical appliances.

Applicants for post (*b*) should have experience of supervising the mechanical and electrical repair and overhaul of all types of electrical appliances, and experience of machine tools and general workshop equipment.

Applicants for either post should be in possession of at least the O.N.C. in Electrical Engineering.

Salary Scale: £616/£646 p.a. Grade L.13, N.J.B. Conditions.

APPOINTMENT OF SENIOR DRAUGHTSMAN, SUB-AREA MAINS ENGINEER'S DEPARTMENT, BOLTON

Applicants should have experience in the preparation of plans for new and existing buildings, layout of indoor and outdoor substations up to 33 kV, overhead line design, and the preparation of schematic and protective system diagrams.

Possession of H.N.C. in Electrical Engineering or equivalent will be an advantage.

Salary Scale: £567/£671 p.a. Schedule "D." Grade 5, N.J.B. Conditions.

Applications for the above posts to the Sub-Area Manager, No. 2 Sub-Area, The North Western Electricity Board, National Buildings, St. Mary's Parsonage, Manchester 3, by 27 Nov., 1954.

APPOINTMENT OF GENERAL ASSISTANT ENGINEER (TESTING ASSISTANT) SUB-AREA TESTING STATION, STALYBRIDGE

Applicants would be required to work as necessary throughout the Sub-Area and should have had experience in the testing and installation of industrial metering equipments, the testing of instruments (including standardisation), protective gear equipment, high voltage testing of cables, transformers and switchgear, and should be qualified to H.N.C. standard in Electrical Engineering.

Salary Scale: £583/£605 p.a. Grade K.13, N.J.B. Conditions.

Applications to Sub-Area Manager, No. 3 Sub-Area, The North Western Electricity Board, Union St, Oldham, by 27 Nov., 1954.

APPOINTMENT OF GENERAL ASSISTANT DISTRICT COMMERCIAL ENGINEER, WHITEHAVEN DISTRICT

The successful applicant will be required to assist in the preparation of estimates and in the supervision of Contract work for Commercial, Industrial and Street Lighting Schemes. Experience in agricultural applications of electricity would be an advantage. H.N.C. standard of education is desirable.

Salary Scale: £466/£486 p.a. Grade F.13, N.J.B. Conditions.

Applications to Sub-Area Manager, No. 6 Sub-Area, The North Western Electricity Board, Castle Green, Kendal, by 27 Nov., 1954. (N 727)

BRITISH ELECTRICITY AUTHORITY
North West, Merseyside & N. Wales Division

VACANCY No. 221/54/T — POWER STATION SUPERINTENDENT at Barton Generating Station, near Manchester. Salary £1,300/£1,450 (N.J.M. 2) Applicants should be qualified engineers with experience of modern steam power plant. An appreciation of modern concepts of administration, financial control and employee relations is desirable. Closing date 30 Nov.

Vacancy No. 223/54/T — STATION SHIFT CONTROL ENGINEER at Barton Generating Station. Salary £641/£667 (H.10). Closing date 30 Nov.

Apply, quoting Vacancy No. to Controller, British Electricity House, 825 Wilmslow Rd, Manchester 20. (N 749)

BRITISH ELECTRICITY AUTHORITY
Eastern Division

APPLICATIONS are invited for the following posts:

3RD ASSISTANT ENGINEER (CIVIL AND MECHANICAL)—TRANSMISSION DEPARTMENT AT DIVISIONAL HEADQUARTERS

Salary Class AX/DX, Grade 5, £649/£858 per annum plus London Weighting.

Applicants should have received training in civil and mechanical engineering and should have preferably qualified for Associate Membership of the Institution of Civil, Mechanical or Structural Engineers.

Applicants should also have had experience in (1) the design and setting out of site works, (2) foundations for buildings and heavy plant, (3) the construction of electrical transmission lines on lattice steel towers.

GENERAL ASSISTANT ENGINEER—TECHNICAL (ELECTRICAL) DEPARTMENT AT LUTON

Salary Class AX/DX, Grade 8, £501/£694 per annum.

The duties include assisting in the commissioning and maintenance of protective gear and electrical plant in transforming and generating stations. The appointment will provide a basis for promotion to a higher technical grade, and applicants should possess qualifications of Graduate I.E.E. standard.

Forms of Application may be obtained from the Authority's Headquarters, or from any Divisional Office of the Authority, and should be addressed to the Controller, British Electricity Authority, Eastern Division, Northmet House, Southgate, N.14, to arrive by 4 Dec., 1954.

W. N. C. CLINCH,
Controller.
(N 728)

EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments.

Norfolk Sub-Area

Sub-Area Headquarters, Norwich
146/54.R

PRINCIPAL ASSISTANT (SALARIES, WAGES AND SUPERANNUATION

Candidates should possess a wide experience of salaries and wages systems, including mechanised methods, and superannuation, pay-roll and personnel records. They should also be conversant with wage award procedure and used to the interpretation and application of agreements.

Salary will be in accordance with Grade 6 (£730 x £25—£805) of the National Joint Council Salary Agreement.

Apply to the Manager, Norfolk Sub-Area, Eastern Electricity Board, 4 Duke St, Norwich, Norfolk.

Northmet Sub-Area

St. Albans and Welwyn Garden City District.
163/54.R

SALES REPRESENTATIVE

The duties will include advising consumers on commercial matters associated with supply, tariffs and apparatus sales, in accordance with the National Joint Council Agreement.

Salary will be in accordance with Grade 1 (£400 x £20—£480 x £10—£490) of the National Joint Council Salary Agreement.

Apply to the Manager, Northmet Sub-Area, Eastern Electricity Board, Northmet House, Southgate, London, N.14.

Future salary and conditions of service for the above appointments will be in accordance with agreements made from time to time by the appropriate negotiating bodies.

The successful candidates will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Applications, by letter, stating age, education, qualifications and experience with details of present appointment and salary, should be submitted to the Manager concerned within fourteen days of the appearance of this advertisement. (N 743)

YORKSHIRE ELECTRICITY BOARD

No. 6 (Hull) Sub-Area

Bridlington District

DISTRICT ENGINEER

APPLICANTS should be Corporate Members of the Institution of Electrical Engineers or possess equivalent qualifications. They must be widely experienced in all branches of electricity distribution work covering Industrial, Urban and Rural Areas with underground and overhead systems.

Salary—N.J.B. Class D, Grade 3, £813/£843 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 6 (Hull) Sub-Area, Yorkshire Electricity Board, Ferensway, Kingston-upon-Hull, not later that 2 Dec., 1954.

No. 1 (Bradford) Sub-Area

Bradford District

GENERAL ASSISTANT DISTRICT ENGINEER

Applicants should have passed the Graduateship Examination of the Institution of Electrical Engineers or hold equivalent technical qualifications; they should have experience in construction, operation and maintenance of high voltage systems, underground cables, overhead lines and substations, and medium and low voltage networks.

Candidates must be prepared to reside within the District and undertake standby duties, if required.

Salary—N.J.B. Class J, Grade 11, £639/£665 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 1 (Bradford) Sub-Area, Yorkshire Electricity Board, 45-53 Sunbridge Rd, Bradford, not later than 2 Dec., 1954.

No. 3 (Sheffield) Sub-Area

Mexborough District

LINESMEN (OVERHEAD POWER) required to carry out all work in connection with the erection and maintenance of overhead transmission, distribution service and street lighting lines, and any equipment or apparatus in connection therewith.

Rate of pay 3s. 7d. per hour, 44-hour, 5-day week. N.J.I.C. conditions of service.

Applications, giving full details of age, qualifications and experience, should be forwarded to the Manager, No. 3 (Sheffield) Sub-Area, Yorkshire Electricity Board, Commercial St, Sheffield, not later than 2 Dec., 1954. (N 729)

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

APPLICATIONS are invited for the following appointments:

(1) GENERATION ENGINEER, Fort Augustus Area—whose duties will include the operation and maintenance of Hydro-Electric Generating Stations in Glen Garry and Glen Moriston and a 132 kV switching and transforming station.

(2) GENERATION ENGINEER, Killin Area—whose duties will include the operation and maintenance of the Finlarig Hydro-Electric Generating Station, 132 kV switching and transforming station and subsequently perhaps of hydro stations in Glen Lochay and Glen Lyon now under construction.

Applicants for the above posts must have sound technical qualifications and have had experience in the operation and maintenance of generating plant, auxiliary plant and switchgear. The salaries will be in accordance with qualifications and experience and subject to adjustment by the appropriate negotiating machinery. Superannuation Scheme applicable.

Application Form obtainable from the Secretary, 16 Rothesay Terrace, Edinburgh 3, must be returned within 14 days from the date of this advertisement. (N 709)

THE UNITED KINGDOM ATOMIC ENERGY AUTHORITY

Aldermaston, Berks

requires an ELECTRICAL ENGINEER in the grade of SENIOR EXPERIMENTAL OFFICER to lead a team to be responsible to a Superintendent for forward estimating of component requirements (mainly electronic), for experimental and small production work. This will involve close liasion with scientists and engineers responsible for development work and with component and valve committees. Applicants should possess a Higher School Certificate (Science), or equivalent, but a degree in electrical engineering or Higher National Certificate with Corporate Membership of the Institution of Electrical Engineers is desirable. First class knowledge and experience of design of commercial electronic components and Type Approval Ministry specifications essential. The salary range (minimum age normally 35) is £982/£1,162 (male) per annum. The successful candidate will probably serve an initial period at Fort Halstead, Kent.

Houses available within a reasonable period for married staff who live outside the Establishment's transport facilities. Application forms from Senior Recruitment Officer, A.W.R.E., Aldermaston, Berks. Quote Ref. 301/WGE/49. (N 694)

SOUTH EASTERN ELECTRICITY BOARD

PRINCIPAL ASSISTANT, SECRETARY'S DEPARTMENT, HEADQUARTERS

SALARY £805 x £30—£895 under N.J.C. Agreement Grade 7. This appointment is within the Organisation and Methods Section and applicants should be interested in and have an aptitude for this kind of work. Possession of a degree or appropriate professional qualification desirable. Experience in the electricity supply industry an advantage. The appointment is subject to the British Electricity Authority and Area Boards' Superannuation Scheme.

Applications, naming 2 referees to A. L. Burnell, F.I.M.T.A., A.A.C.C.A., Secretary, SEEBoard, 10 Queen's Gdns, Hove 3, Sussex by 1 Dec., 1954.

A. L. BURNELL,
Secretary.
(N 746)

BRITISH ELECTRICITY AUTHORITY

East Midlands Division

ASSISTANT MAINTENANCE ENGINEER (MECHANICAL) DRAKELOW POWER STATION

Vacancy No. 176/54/ET.

PREVIOUS operation and maintenance experience with modern high pressure plant, with technical qualifications up to H.N.C. standard essential.

Salary in accordance with Class J, Grade 8 (£764/£796 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 25 Nov., 1954.

This amended advertisement replaces Vacancy No. 164/54.

ASSISTANT MAINTENANCE ENGINEER (ELECTRICAL) DRAKELOW POWER STATION

Vacancy No. 177/54/ET.

Previous operation and maintenance experience with all types of electrical plant in a modern Power Station, with technical qualifications up to H.N.C. standard as a minimum requirement.

Salary in accordance with Class J, Grade 8 (£764/£796 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 25 Nov., 1954.

This amended advertisement replaces Vacancy No. 165/54.

These appointments will be pensionable within the terms and provisions of the British Electricity Authority and Area Boards Superannuation Scheme.

Applications should be submitted on the official form A.E.6/ACT, which may be obtained from the Divisional Establishment Officer, British Electricity Authority, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated. Please quote Vacancy Number.

L. F. JEFFREY,
Divisional Controller.
(N 748)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments, which are superannuable and subject to medical examination:

(1) ENGINEERING DRAUGHTSMAN in the No. 4 Sub-Area of the Board, Electricity Hse, Rhostyllen, near Wrexham. Salary within range £433/£567 p.a. (N.J.B. D/6).

Applicants should be experienced in draughtsmanship for one or more of the following: Building and Civil Engineering; Electrical Engineering; Structural Steelwork; Overhead Lines; and possess at least the Ordinary National Certificate.

Standard application forms, obtainable from the Manager at the above address, should be completed and returned not later than 29 Nov., 1954.

(2) SENIOR ASSISTANT (CONSUMERS' ACCOUNTS), to be directly responsible to the Superintendent in charge of Income Accounting, in the No. 2 Sub-Area Accountant's Department, Eversley, Frodsham. Salary within range £670/£730 p.a. (N.J.C. Grade 5).

The work involves control of staff engaged on consumers' accounting, including meter reading and collection, billing and relative statistics. Experience of such work in a public utility undertaking or a sales ledger office desirable.

Applications, stating age, education, experience, and qualifications, should be sent to the Manager, No. 2 Sub-Area, Sandiway Hse, near Northwich, Cheshire, so as to be received no later than 29 Nov., 1954.

(N 710)

ELECTRICAL TECHNICIANS

as shown below are required by the ZANZIBAR GOVERNMENT for one tour of 2—3 years on contract. Salary scale (including present temporary allowance of £192/£257 a year) £782 rising to £1,097 a year. Commencing salary according to qualifications and experience. Gratuity of 13½% of total basic salary drawn during contract. Outfit allowance up to £60. Free passages. Liberal leave on full salary.

(*a*) INSTRUMENT MECHANIC (M2A/30676/EE). Candidates must have served an apprenticeship and hold the O.N.C. in Electrical Engineering or equivalent, with not less than 3 years' experience in the meter department of a supply undertaking or meter manufacturer's works. They should be able to carry out repairs to single and polyphase house service meters and switchboard instruments.

(*b*) ARMATURE WINDER (M2A/30678/EE). Candidates must have served an apprenticeship and hold the O.N.C. in Electrical Engineering or equivalent with not less than 5 years' experience in the winding of A.C. and D.C. machines up to 11 kV. They should be capable of rewinding a 1,000 kVA, 11,000 V alternator stator.

(*c*) PLUMBER-JOINTER (M2A/30679/EE). Candidates must have served an apprenticeship and hold the O.N.C. in Electrical Engineering or equivalent with not less than 5 years' experience in the joining of cables up to 11 kV. Write to the Crown Agents, 4 Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience and quote reference No. of appointment applied for. (N 692)

BRITISH ELECTRICITY AUTHORITY

Midlands Division

JUNIOR ENGINEER is required at Hams Hall "B" Power Station. N.J.B. service conditions, superannuable appointment, salary within Schedule "A" of the Agreement, Grade K15, £545 per annum.

A sound technical education and practical training are required, and preferably some experience within a large modern power station. Appropriate technical qualifications an advantage.

Apply, quoting Vacancy No. 821MD on form AE6, available from the Establishments Officer, 53 Wake Green Rd, Moseley, Birmingham 13 by 4 Dec, 1954. (N 745)

BRITISH ELECTRICITY AUTHORITY
London Division

APPLICATIONS are invited for the following superannuable posts. Conditions of service in accordance with N.J.B. Agreement, Schedule A or C. Salary includes London Allowance. Qualifications entitling to Graduate Membership of the I.E.E. or I.Mech.E. for posts (*a*) and Corporate Membership for post (*b*) an advantage.

(*b*) STATION SUPERINTENDENT
BECKENHAM GENERATING STATION
Vacancy No. 54/950

Candidates must possess good administrative, organising and managerial abilities. Practical and technical training with Power Station operation and maintenance experience is essential. Salary—Class B, Grade 1=£919. 16s. p.a.

(*a*) ASSISTANT SHIFT CHARGE ENGINEER
HACKNEY GENERATING STATION
Vacancy No. 54/951

Experience necessary on modern boiler and turbine plant, P.F. and stoker fired boilers and E.H.T. switchgear. Salary—Class H, Grade 9=£714 p.a.

(*a*) STATION SHIFT CONTROL ENGINEERS
(1) BANKSIDE GENERATING STATION
Vacancy No. 54/952
(2) HACKNEY GENERATING STATION
(5 Vacancies)
Vacancy No. 54/953

Sound engineering training with some experience in control and operation of steam generating plant and main switchgear in modern power station. Salary—Class H, Grade 10=£673. 1s. p.a.

(*a*) ASSISTANT APPRENTICE INSTRUCTOR
Vacancy No. 54/954
BASIC TRAINING WORKSHOP AT BANKSIDE, S.E.1.

Applicants should have sound practical and technical training in Mechanical Engineering with Workshop experience in Blacksmithing and Welding. They will be required to carry out instruction in the Basic Mechancial Engineering skills to enable the Apprentices to acquire the elements of Blacksmith's and Welder's techniques. Ability to assist with machine tool demonstration an added advantage. Salary—Class AX/EX, Grade 8, in scale £526. 1s./£749. 11s. p.a. with starting point according to qualifications.

Applications, quoting vacancy number, may be made on form obtainable from Divisional Secretary, British Electricity Authority, London Division, P.O. Box 136, Generation House, Great Portland St, W.1, and be received within 14 days of this advertisement. (N 738)

SURREY COUNTY COUNCIL

APPLICATIONS are invited for appointment of ASSISTANT ELECTRICAL ENGINEER, Grade V, Salary £620 by £15/£20/£670 p.a. plus London Weighting. Applicants should be experienced in preparation of schemes, specifications, drawings and estimates for, and supervision of, installations of electrical services in buildings.

Applications giving full details of present and previous appointments and salary attaching thereto, accompanied by copies of 3 recent testimonials, to County Architect, County Hall, Kingston, by 27 Nov., 1954. (N 693)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

COMMERCIAL ASSISTANT (TECHNICAL) required in the Runcorn District. Salary £524/£540 p.a. (N.J.B. E/11). Appointment superannuable and subject to medical examination.

Applicants must have had an Engineering training, and preferably have the qualifications necessary to enable them to become Chartered Electrical Engineers.

Standard application forms, which are obtainable from any of the Board's offices, should be completed and forwarded to the Manager, No. 2 Sub-Area, Sandiway House, near Northwich, Cheshire, not later than 29 Nov., 1954. (N 735)

BRITISH ELECTRICITY AUTHORITY
South Wales Division

Vacancy No. 109/54

APPLICATIONS invited for superannuable N.J.B. appointment of FIRST ASSISTANT STATION CHEMIST, Uskmouth Power Station. Salary K9, £766/£796 per annum.

Degree in Chemistry or equivalent and experience in Water Treatment, Coal and Oil testing and Corrosion problems desirable.

Application forms obtainable from Secretary, South Wales Division, British Electricity Authority, Twyn-y-Fedwen Rd, Gabalfa, Cardiff, to be returned by 3 Dec., 1954. (N 751)

OVERHEAD LINESMAN

required by ZANZIBAR GOVERNMENT for one tour of 2-3 years on contract. Salary scale (including present temporary allowance of £192/£257 a year) £782 rising to £1,097 a year. Commencing salary according to qualifications and experience. Gratuity of 13½% of total basic salary drawn during contract. Outfit allowance up to £60. Free passages. Liberal leave on full salary. Candidates must have served an apprenticeship and hold the O.N.C. in Electrical Engineering or equivalent with not less than five years' experience of construction and maintenance of L.T. and 11 kV overhead lines and services.

Write to the Crown Agents, 4 Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience and quote M2A/30667/EE. (N 725)

BRITISH ELECTRICITY AUTHORITY
Southern Division

APPLICATIONS are invited for the following positions:—

ENGINEER (GRADE 10).
POOLE GENERATING STATION
S/13.586

The successful candidate may be called upon to perform the duties of a Station Shift Control Engineer, to assist on maintenance work, or to perform general station duties. Operating experience of modern generating station plant is essential.

Applicants should have had a sound technical training and should possess qualifications leading to corporate membership of an appropriate professional institution. Salary N.J.B. H/10, £641/£667.

ENGINEER (GRADE 9)
S/13.587
AND
SHIFT CONTROL ENGINEER
S/13.588
SOUTHAMPTON GENERATING STATION

The grade 9 Engineer may be required to undertake duties in either the boiler house or turbine room.

Applicants should have had appropriate previous experience in a modern generating station, and manufacturing works experience will be an advantage. Preference will be given to those who either possess qualifications and experience leading to corporate membership of a recognised professional institution, or who are studying for the examinations of such an institution.

Salary: Grade 9 Engineer: N.J.B. F/9 £607/£629.
Control Engineer: N.J.B. F/10 £577/£598.

GENERAL ASSISTANT ENGINEER
TRANSMISSION DEPARTMENT, PORTSMOUTH
S/13.589

Applicants should have had experience in the operation and maintenance of a high voltage system and preferably should have received a works training on high voltage switchgear and transformers. Candidates should possess a Higher National Certificate, or its equivalent, and possession of qualifications leading to corporate membership of an appropriate professional institution will be an advantage.

Salary N.J.B. AX/CX 8, £501/£675.

Special application forms for each of the above positions, obtainable from P. D. A. Oliver, Divisional Secretary 111 High St, Portsmouth, should be returned by 1st Dec. Please quote ref: E.T. (N 742)

SOUTHERN ELECTRICITY BOARD

ASSISTANT ENGINEER (PLANNING)

ISLE OF WIGHT District of No. 3 (Portsmouth) Sub-Area. Salary N.J.B. Class E, Grade 10 (£555/£562/£569 per annum). N.J.B. Conditions of Service.

The duties of the post will be to assist the Planning Engineer in the preparation of schemes and estimates for extensions of and reinforcement to overhead and underground H.V. and L.V. networks, and will be required to undertake standby duties if required. The possession of suitable technical qualifications will be an advantage.

ASSISTANT ENGINEER
(MAINTENANCE AND OPERATION)

Aldershot District of No. 3 (Portsmouth) Sub-Area. Salary N.J.B. Class F, Grade 12, Column 1 (£507 per annum). N.J.B. Conditions of Service.

The duties of the post will be to assist generally with the operation and maintenance of the H.V. and L.V. overhead and underground distribution systems working at voltages up to 33,000. The qualifications are sound technical training and experience; preference will be given to those applicants who possess technical qualifications up to A.M.I.E.E. standard. The appointment will involve standby duties.

The successful candidates will be required to contribute to the B.E.A. and Area Boards' Superannuation Scheme, if eligible.

Applications for the above appointments should be made on forms obtainable from the Sub-Area Secretary, Lower Drayton Lane, Cosham, Portsmouth, and returned to him in envelopes suitably endorsed not later than 3 Dec., 1954. (N 741)

THE NORTH EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments:

WEAR SUB-AREA—DEMONSTRATOR WITH LOCATION AT CHESTER-LE-STREET DISTRICT

TEES SUB-AREA—DEMONSTRATOR WITH LOCATION AT REDCAR SERVICE CENTRE

Applicants should have a certificate of a recognised Domestic Science Training College and/or E.A.W. certificate, preferably the latter; also considerable experience as a Demonstrator or Assistant Demonstrator in the Electricity Supply Industry. Salary—Grade 1—£400/£490. Annual increments of £20 up to £440; beyond £440, increments subject to certificate of competence. N.J.C. conditions of service.

Applications stating age, qualifications and experience, should be forwarded to the Secretary (Establishments), The North Eastern Electricity Board, G.P.O. Box No. 117, Carliol House, Newcastle upon Tyne 1, within ten days of the appearance of this advertisement. (N 744)

BRITISH ELECTRICITY AUTHORITY
East Midlands Division

APPLICATIONS are invited for the position of GENERAL ASSISTANT ENGINEER in the Transmission Department at this Divisional Headquarters.

Applicants should have experience in the manufacture, design or installation of high voltage transmission equipment and should preferably be a Graduate Member of the Institution of Electrical Engineers.

Salary will be within Class AX/DX, Grade 8 (£501/£694 per annum) of the National Joint Board Agreement.

This appointment will be pensionable within the terms and provisions of the British Electricity Authority and Area Boards Superannuation Scheme.

Closing date for receipt of applications, 2 Dec., 1954.

Applications should be submitted on the official form A.E.6/ACT, which may be obtained from the Divisional Establishment Officer, British Electricity Authority, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated. Please quote Vacancy Number 175/54/ET.

L. F. JEFFREY.
Divisional Controller.
(N 747)

LONDON ELECTRICITY BOARD

DEMONSTRATORS

APPLICATIONS are invited for the above positions in the Greenwich, Beckenham/Bromley, and Bermondsey Districts of the Southern Sub-Area.

Applicants should be suitably qualified, holding the E.A.W. or other approved certificate including electrical housecraft, and have experience in conducting demonstrations at Service Centres and in general service centre duties. They should also be experienced in advising consumers on the selection and use of domestic appliances, both at the Service Centre and on consumers' premises.

The posts are graded within the National Joint Council agreement (Administrative and Clerical Grades) as Grade 1, i.e. £400/£490 per annum, plus the appropriate London Area Allowance.

Application forms obtainable from Personnel Officer, 46 New Broad St, E.C.2, to be returned completed within 10 days of the publication date of this advertisement. Please enclose addressed envelope and quote ref.: V/1803/T. (N 734)

BRITISH ELECTRICITY AUTHORITY
Midlands Division

APPOINTMENT OF ESTABLISHMENTS OFFICER

APPLICATIONS are invited for the position of Establishments Officer, Midlands Division, at a salary within the scale of Principal Assistant, £1,000 x £40 to £1,120 per annum. The post is superannuable under the provisions of the British Electricity Authority and Area Boards Superannuation Scheme.

Candidates must have had a sound general education, possess good organising ability and have had experience of negotiation and joint consultation work either in the electricity supply industry or in a large industrial concern. The possession of a recognised professional qualification will be considered an advantage.

Applications should be forwarded to the Divisional Secretary, 53 Wake Green Rd, Moseley, Birmingham 13, not later than 29 Nov., 1954. (N 726)

LONDON ELECTRICITY BOARD

ENGINEERING DRAUGHTSMAN

APPLICATIONS are invited for the above position in the Design and Planning Branch of the North Western Sub-Area in Central London.

Applicants should have had a good general and technical education in electrical engineering and building construction, and experience in a mains records office dealing with systems of all voltages up to 11 kV.

The post is graded under Schedule "D" of the National Joint Board Agreement as Grade 6—£458/£595. 7s. per annum, inclusive of London Allowance.

Application forms obtainable from Personnel Officer, 46 New Broad St, E.C.2, to be returned completed by 30 Nov., 1954. Please enclose addressed envelope and quote ref: V/1820/T. on envelope and all correspondence.

(N 691)

TRAINING OFFICER

required for the ELECTRICITY DEPARTMENT, GOLD COAST LOCAL CIVIL SERVICE for two tours of 18 to 24 months on contract. Consolidated salary scale £1,330 rising to £1,680 a year. Gratuity at the rate of £150 a year. Outfit allowance up to £60. Free passages. Liberal leave on full salary. Candidates, over 28, should have served a recognised apprenticeship in mechanical or electrical engineering and have had at least 3 years' experience in the operation of modern technical training schemes. Preference will be given to candidates holding H.N.C. in Mechanical or Electrical Engineering or O.N.C. in Mechanical and Electrical Engineering or similar qualifications. Write to the Crown Agents, 4 Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience and quote M2A/40525/EE. (N 711)

INSTRUCTOR IN GENERAL ELECTRICAL ENGINEERING

required by the MOMBASA INSTITUTE OF MUSLIM EDUCATION, KENYA, for one tour of 3 years in the first instance with prospect of further employment by mutual agreement. Salary scale (including present temporary allowance of £165/£300 a year) £715 rising to £1,325 a year. Commencing salary according to age, qualifications and experience. Outfit allowance £30. Contributory superannuation scheme. Free passage and free furnished quarters. Liberal leave on full salary. Candidates should have served an appropriate apprenticeship and have wide subsequent practical experience including Outside Wireman's work. They must be capable of instructing in all forms of general electrical engineering both in theory and in practice, and should hold a C. and G. Certificate or equivalent qualification.

Write to the Crown Agents, 4 Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience and quote M2C/30683/EE. (N 724)

ASSISTANT LECTURER
Electrical Engineering

required for the EDUCATION DEPARTMENT, NIGERIA, for two tours of 18 to 24 months or three tours of 10 to 12 months in the first instance. Option of appointment either (*a*) on agreement with prospect of permanency with salary in scale (including expatriation pay) £750 rising to £1,315 a year or (*b*) on contract with salary in scale (including expatriation pay) £807 rising to £1,453 a year plus gratuity at the rate of £100/£150 a year. Outfit allowance £60. Free passages for the officer and wife. Assistance towards cost of children's passages or grant up to £150 annually for maintenance in U.K. Candidates should hold the H.N.C. in Electrical Engineering or equivalent qualification and have had previous teaching and industrial experience. Write to the Crown Agents, 4 Millbank, London, S.W.1 State age, name in block letters, full qualifications and experience and quote M2A/30630/EE. (N 712)

A SENIOR TECHNICAL DESIGNER with first-class experience of the design of electrical accessories is required in London by The General Electric Co., Ltd. Wide experience in a works design office is essential, together with the ability and keenness to make a real contribution to the developments of the Company's electrical accessories. Applications giving full details of record and experience should be addressed to the Staff Manager (Ref. ELS), The General Electric Co., Ltd., Magnet Hse, Kingsway, London, W.C.2. (N 718)

A PROGRESSIVE position in expanding South East England company is offered for person experienced in all branches of SALES OFFICE organisation; able to work with minimum supervision. Electronic or electrical background an asset. Suitably qualified applicants are invited to write giving details of experience to Box Z906, Willing's 362 Grays Inn Rd, London, W.C.1. (N 699)

AN OPPORTUNITY OCCURS in progressive manufacturing concern in London area for ENGINEER, aged 25/35, with electrical or physicist degree, on development and research work on high frequency telecommunication cable and associated testing equipment. Salary will be commensurate with qualifications and experience. Apply, giving full particulars to—Box No. 4003, Electrical Times. (N 663)

APPLICATIONS are invited from ENGINEERS of INTER-B.SC., or Higher National Certificate standard for investigational work on thermionic valves. Five-day week, staff pension scheme, modern welfare amenities. Apply, giving full particulars of age, qualifications and experience to Personnel Superintendent, The Edison Swan Electric Co., Ltd., Cosmos Works, Brimsdown, Enfield, Middlesex. (N 716)

APPLICATIONS are invited from suitably qualified persons for the position of POWER PLANT SUPERINTENDENT on a Northern Rhodesia copper mine.

The installed generating capacity of the station is 45·0 MW, turbo blower capacity 80,000 c.f.m. at 15 pounds per sq in. and installed compressor capacity 54,000 c.f.m. at 90 pounds per sq in.

The boiler plant consists of 11 by 80,000 pounds per hour boilers and 4 by 40,000 pounds per hour boilers. Ten of the 80,000 per hour boilers are associated with reverberatory furnaces and approximately one-third of the steam output of the station is derived from waste heat from the reverberatory furnaces.

Applicants should have had at least eight years experience in a power station of the same or larger capacity and should have held the position of power plant superintendent or assistant power plant superintendent. Preference will be given to graduate engineers.

The salary will depend on the qualifications and experience of the successful applicant. The starting salary for this position will be at least £120 per month. In addition a cost of living allowance is paid plus a cash bonus based on the difference between the production cost and the selling price of copper, at present amounting to 60% of the basic salary.

The Corporation will bear the cost of first class transportation for the successful candidate and his immediate family to Kitwe, Northern Rhodesia.

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Applications stating age, marital status, qualifications, experience and availability should be addressed by airmail to the General Manager—Box 137, Kitwe, Northern Rhodesia. (N 646)

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CONTRACTS ENGINEERS required for handling of Switchgear tenders and contracts. Applications should state age, experience, qualifications and salary required and should be addressed to Personnel Manager, South Wales Switchgear Ltd., Blackwood, Mon. (N 644)

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DEMONSTRATOR (lady) required, to assist in the Electrical Section, The Building Centre, W.C.1. Commencing salary £430 p.a. Write, giving age and full details of education and experience to the Director, British Electrical Development Association, 2 Savoy Hill, W.C.2. (N 750)

DRAUGHTSMAN required by manufacturing electrical engineers in Birmingham, for general design of F.H.P. motors. Man with good experience in small mechanism considered. Good salary for suitable applicant, state age, qualifications and experience.—Box No. 4023, Electrical Times. (N 731)

Box No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London, W.C.2.

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Apply in writing, giving age, experience, etc., to manager, drawing offices, British Thomson-Houston Co., Ltd., Rugby. (N 722)

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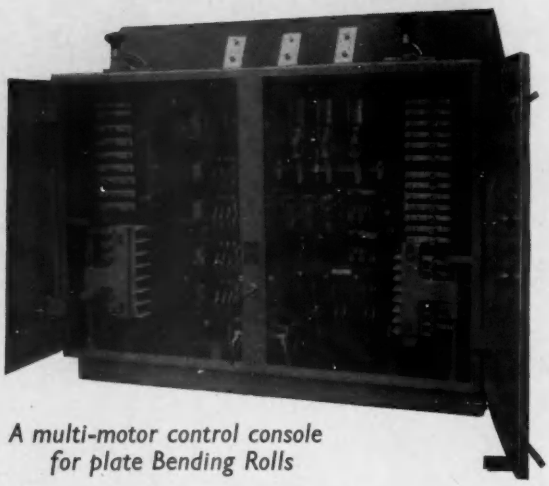

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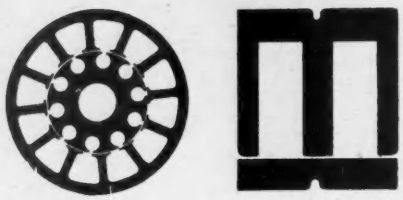

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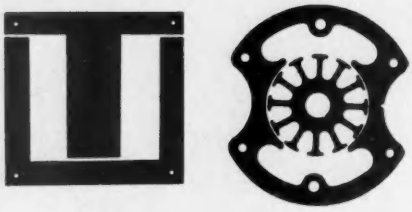

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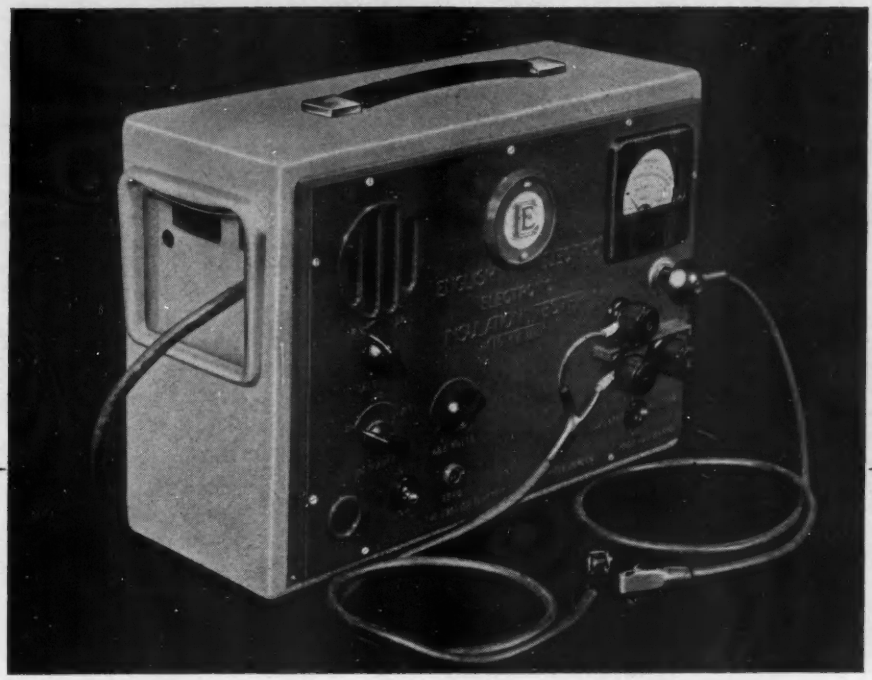

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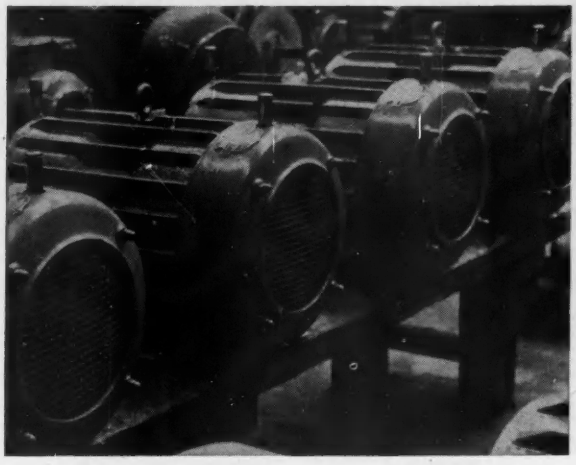

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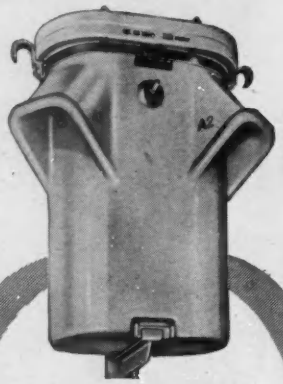

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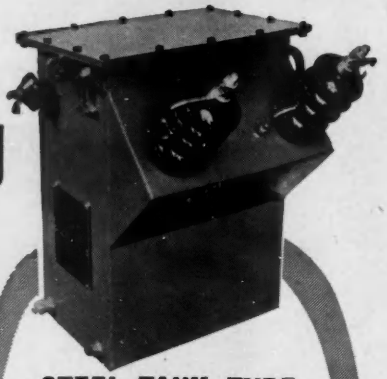

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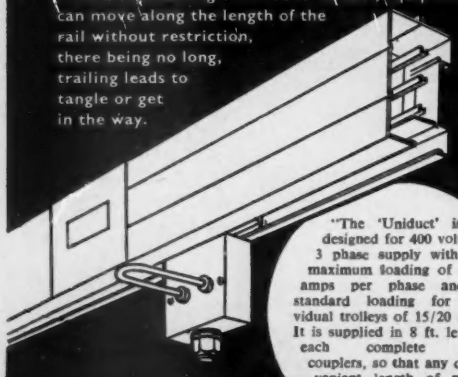

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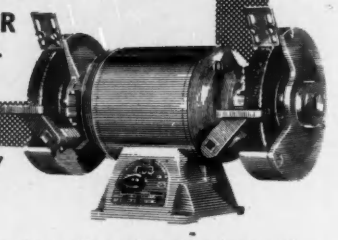

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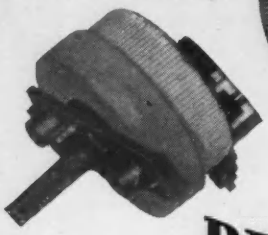

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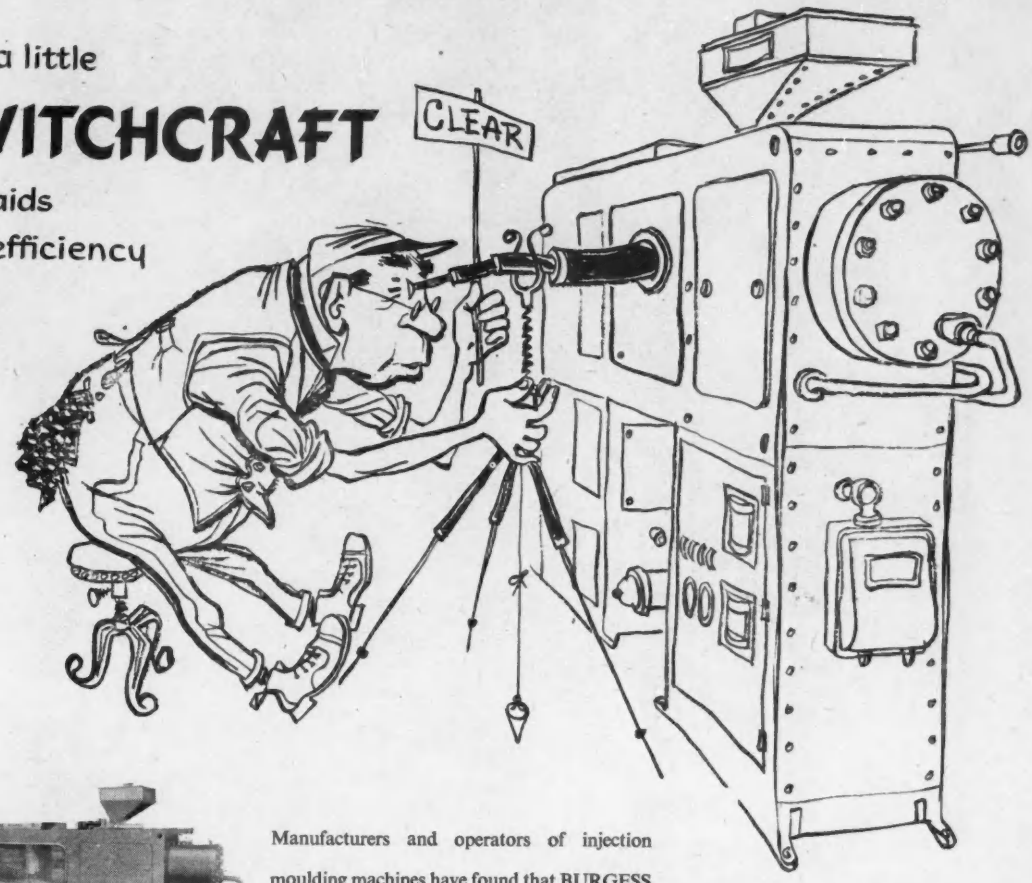
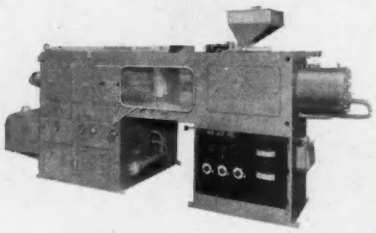
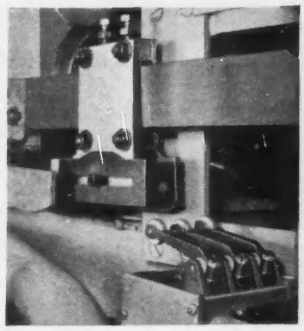




Manufacturers and operators of injection moulding machines have found that BURGESS MICRO-SWITCHES solve many problems; in doing so they provide infallible accuracy where "the human element" could make costly mistakes. The 'Peco' Model M40 8/12 oz. Injection Moulding Machine illustrated, for example, uses eight BURGESS MICRO-SWITCHES—four type Mk. 3BR-MS and four type Mk. 3BR-MS/A—which start and control the moulding cycle and operate safety devices. The three type Mk. 3BR-MS/A MICRO-SWITCHES seen in the detail illustration on the right are actuated by cams and control a sequence of operations. Another BURGESS MICRO-SWITCH provides sensitive protection to the tools by preventing the application of high pressure after the platen has closed under low pressure should there be any foreign matter—even something so small as a piece of paper—between the die faces.



The type Mk. 3BR-MS/A BURGESS MICRO-SWITCH is provided with a die-cast zinc alloy housing with a drop forged steel actuating arm and case hardened steel roller. The type Mk. 3BR-MS switch has a similar housing, but no actuating arm. For further details of these models and many more, please consult CATALOGUE No. 50/D.

Photographs above and left by courtesy of the Projectile & Engineering Co. Ltd.

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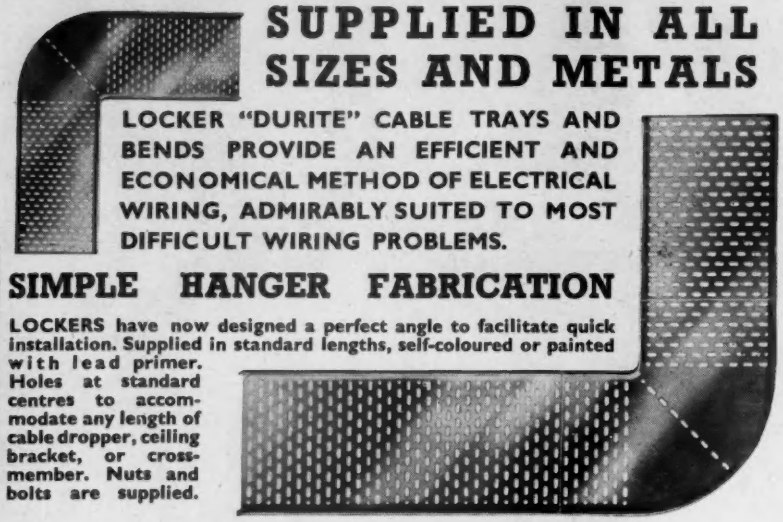

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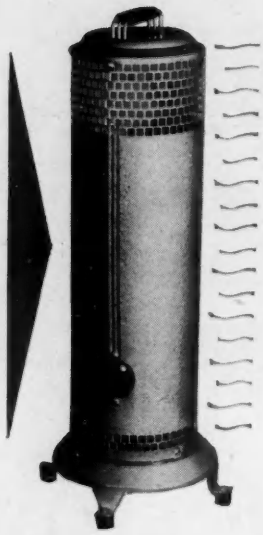

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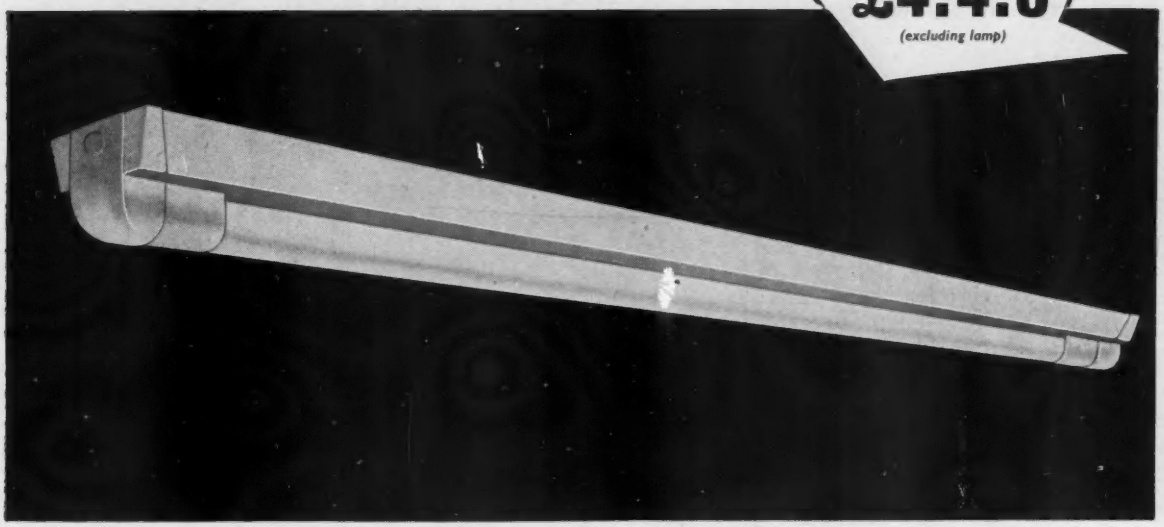

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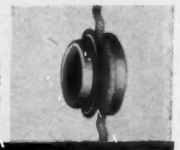

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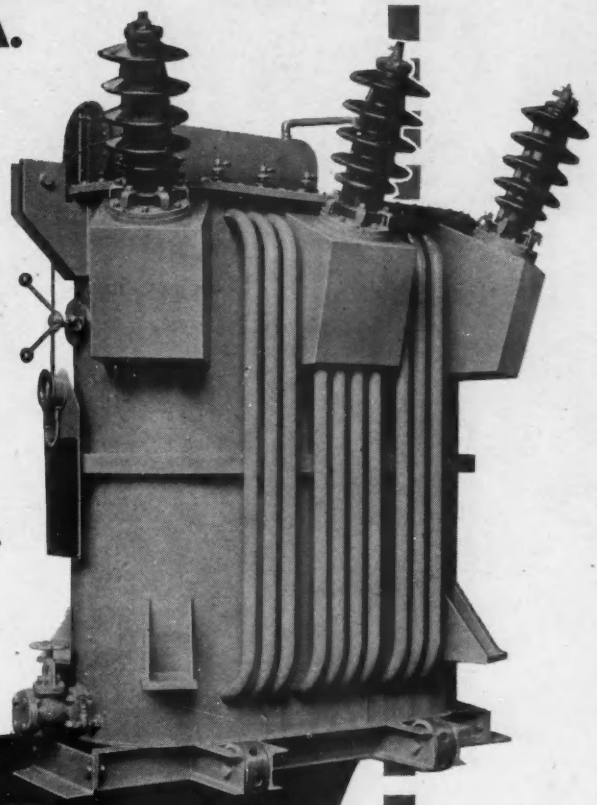

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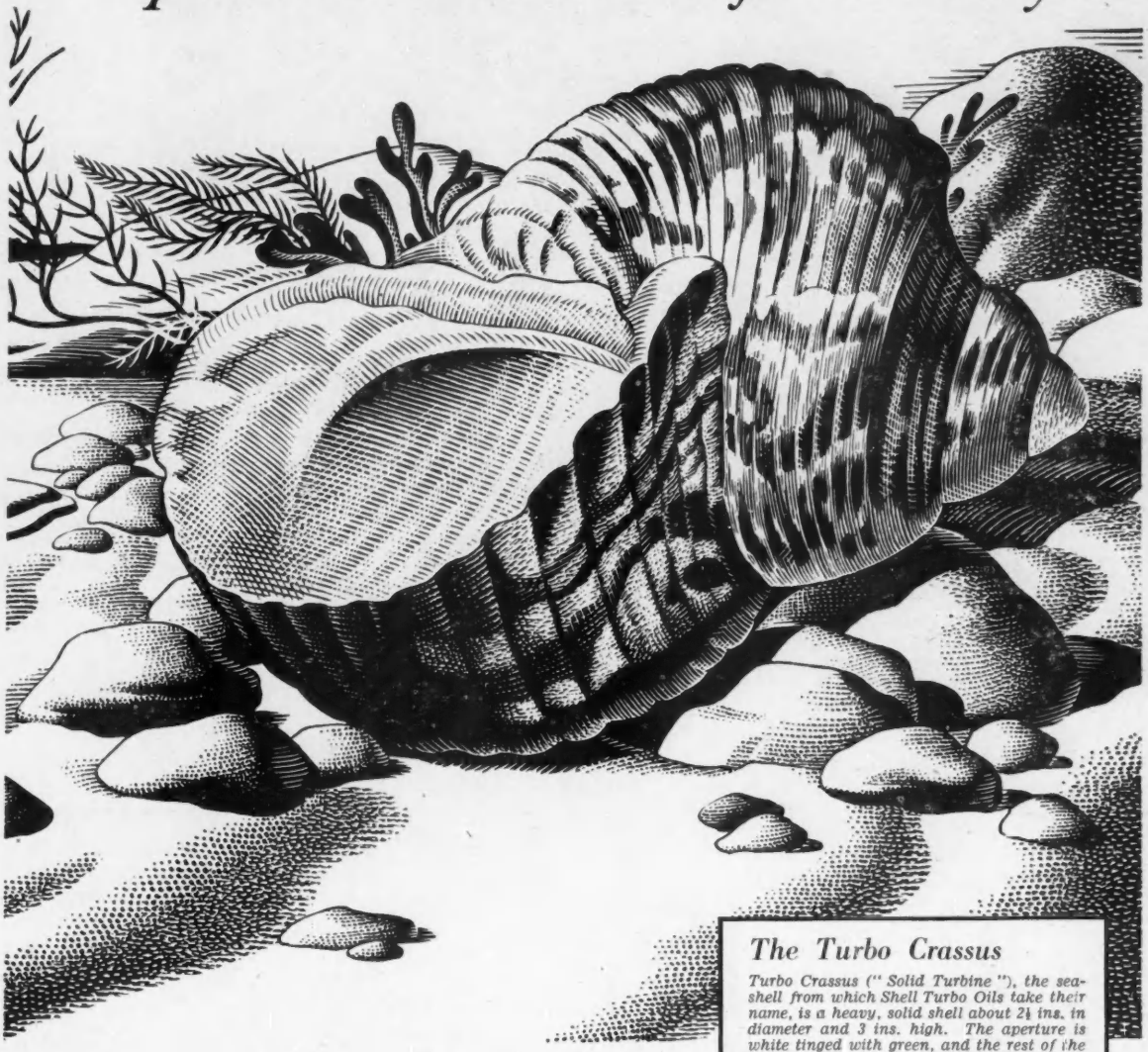

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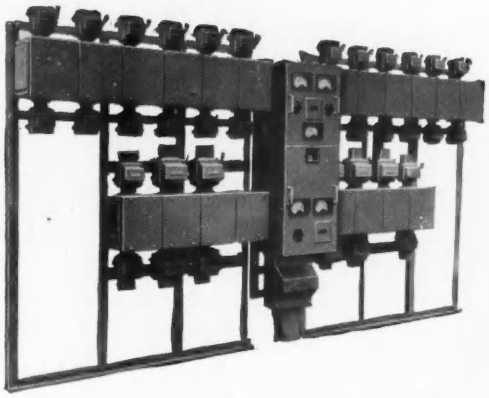

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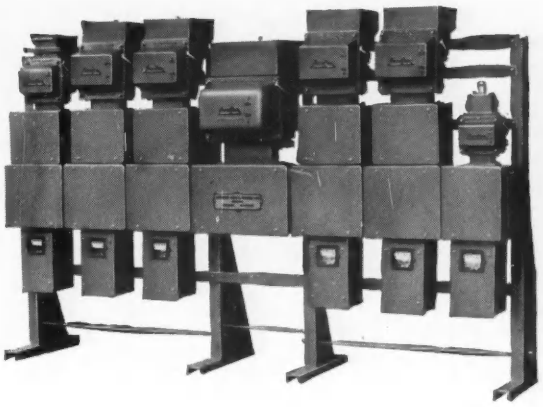
Switchboard supplied through B. French Ltd., and installed at the Carrickfergus, Co. Antrim plant of Courtaulds Ltd.



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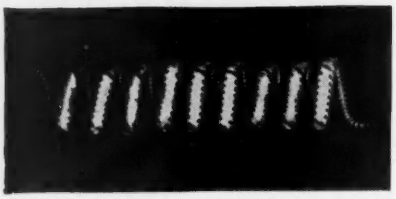
Greater All-Round Value



To take this completely unretouched photograph, the cathode was buried in a "Perspex" block, which was then polished down until the coated turns were cut, and a time exposure made with a projection microscope.

THE NEW BTH CATHODE

The illustration shows clearly how solidly the all-important emissive material is packed into the enlarged primary coil.

The secret lies in a far more ductile tungsten wire developed by BTH research. Tougher, more resilient cathodes are now being drawn and coiled, and the whole "geometry" of the design has been improved.

Mazda Fluorescent lamps stay brighter longer

B T-H

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